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VIEWS, NEWS AND INTERVIEWS.

"That's a lovely kind of a paper you run," sarcastically observed a representative of a prominent electrical manufacturing company to an ELECTRICAL REVIEW man.

"Exactly. What especially pleases you?"

"Great guns! Don't we pay the REVIEW a whole lot of money every year for advertising?"

"Dunno."

"Well, the manager tells me he does, anyway. I know we're carrying an advertisement in your paper now, and why should the REVIEW go and queer a sale for me?"

"Dunno."

"Don't know? Why, ding it all, what do you suppose I'm hot about?"

"Dunno."

"Well, I'm hot about this. I was up here in New York State a few days ago, and the first man I saw in the morning was a central station manager. I had talked to him for half an hour about the merits of my apparatus, showed him where he could save a lot of money, and had my hand ready to write an order for him to sign. Then, b'gosh, in comes a little office boy about two feet and a half high, bringing the mail. This manager fellow immediately stops talking to me, runs over his mail, pushes aside the letters and other stuff, singles out a paper, rips the wrapper and begins to read the ELECTRICAL REVIEW! Then he tells me he's busy and to come and see him again. Gee whiz! I'm hot, and you've lost me a good sale. What are you going to do about it?"

"Dunno. Sure it was the REVIEW the man was reading?"

"Sure? Why, don't I read it myself? Think I don't know that yellow cover?"

"Dunno. Anyway, you're certain there's at least one central station manager reads the REVIEW, aren't you?"

"Sure! Why, —— ——!"

"Good morning."

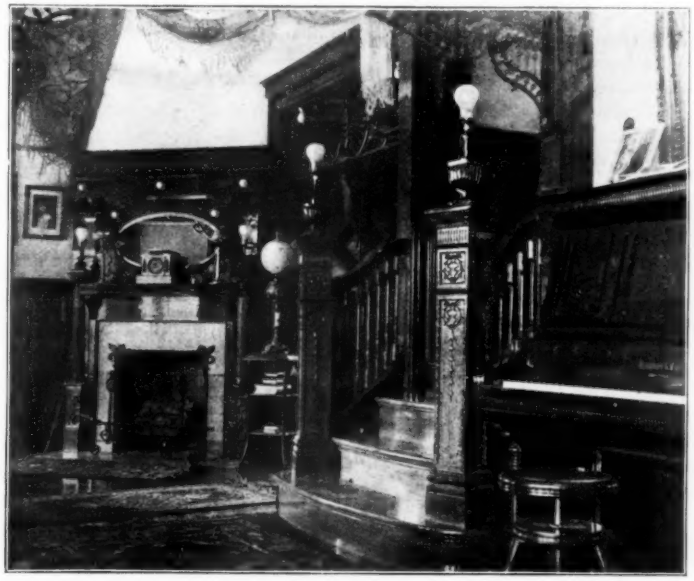
"—— —— ——!"

As the result of a conference between M. Thebeau, First Secretary of the French Embassy, and Assistant Secretary Day, the United States and France will jointly maintain a cable line to St. Thomas in the Danish West Indies. It will be of great service to the United States in the event of war with Spain.

Sixteen thousand dollars is said to be the record price paid for a cablegram, that price having been paid for a message sent by Mr. Henniker Heaton to Australia in behalf of the British Parliament. Reuter's account of the murderer Deeming's trial, 4,000 words, cost $8,000. An 1800-word dispatch from London to Argentina cost $7,500. The most expensive private message so far is that sent by the King of Italy to the Duke of Abruzzi at Rio Janeiro, informing him of the death of his father, the late Duke of Aosta, which cost $2,670.

At the Sussex County Teachers' Institute, held in Milford, Del., recently, a lady teacher boarding at the Windsor Hotel tried to blow out the electric light. Being unable to blow it out, she wrapped a skirt around it, but the skirt would not stay, so she tried to fan it out, and in her exertion struck it, and it broke. She succeeded.

Senator Wetmore presented to the Senate last week a report from the Librarian of Congress to the effect that Mrs. Gertrude M. Hubbard, widow of Gardiner Green Hubbard, the well known telephone man, has presented her late husband's magnificent collection of etchings and engravings to the American people, to be preserved in the Library of Congress. The Hubbard collection represents the finest productions of the modern schools of art, and, when taken in connection with the large number already in the Library under the operation of the copyright law, will make the Library gallery one of the largest and most representative in the world. Mrs. Hubbard also provides a fund of $20,000, the interest of which will be devoted to the increase of the collection.



INTERIOR VIEW IN A BUFFALO, N. Y., RESIDENCE, SHOWING ELECTRICAL DECORATIONS AND EFFECTS.

Prof. Luigi Lombardi has been appointed professor of technical physics at the Industrial Museum of Turin to fill the chair which was left vacant by the death of Prof. Galileo Ferraris.

DOMESTIC ELECTRICITY.

AN INTERESTING INSTALLATION IN A BUFFALO RESIDENCE.

An electrical gem has just been completed by Frank C. Perkins, electrical engineer, at 655 Prospect avenue, Buffalo, N. Y., to show what can be done in fitting complete a modern house with electrical appliances. Most of these are in use in various modern houses, but have not been embodied in a single residence.

Arriving home in the evening, stepping on a floor tread on the top step of the veranda lights the incandescent lamps on the veranda and the vestibule. On passing into the vestibule and closing the door the lights are automatically turned out and the lights are lit on the first landing. In the oak panel work a secret door is opened and switches there will light any room upstairs before reaching it; the hall, bath-room, attic or any chamber will be found brilliantly lighted on reaching it. Callers speaking from the front door to sewing-room, nursery or other rooms may be admitted by pressing a button, the front door opening automatically.

The old-style burglar alarms are replaced by a new method, and if any door or window is forced open the electric lights on the veranda and in the vestibule are immediately lighted and the usual bell alarm given in the kitchen.

The temperature of the whole house is electrically controlled to 60 degrees, while the lower rooms are separately controlled to 70 degrees, and once setting in the Fall, the heat is evenly distributed throughout the year.

Electric wires are provided for charging an electric carriage, which passes down an inclined cement pavement into the basement. The barn is thus done away with. The carriage may be charged while you are sleeping or eating your dinner.

Electric wires, plugs and switches are provided for electric heaters, electric cooking apparatus in the kitchen and electric knife sharpener and coffee grinder. In the dining-room the coffee or tea is kept warm on the

sideboard by the electric heater, while in the parlor dainty bits may be cooked on the electric chafing-dish.

The lighting effects in this house are novel and interesting. No chandeliers are to be found in reception hall, parlor or dining-room. The electric lighting is accomplished by electric-ground glass globes in the side walls and ceilings, back of panels of chipped and opal glass shedding a soft, subdued light about the rooms with none of the fixtures of the past.

A choke coil constructed on the plan of the theater dimmers allows the voltage of the alternating current furnished by the Buffalo General Electric Company to be varied at will, increasing or decreasing the brilliancy of the lamps.

Every 10 lamps of 16-candle-power are equivalent to one horse-power of energy; 95 per cent of this energy is heat and five per cent light, and by placing these lamps in hot-air conductor pipes back of the glass panels referred to, the heat is conducted to registers on the first or second floor as desired. Either natural gas or electricity may be used for lighting or cooking, as both are provided.

In the bath-room the electric shaving cup is at hand, and an instantaneous heater gives hot water as long as the spigot is left open, so that once emptying the tank does not leave other members of the family with cold water.

In the sewing-room a switch and plug is provided for the operation of a sewing-machine by motor controlled by the foot, while in the den the electric cigar lighter is in a convenient position.

The sleeping-rooms are provided with the usual calls, electric lights controlled from within the room or below, as desired, while the electric curling-iron heater is within reach on the bureau.

The laundry is wired for electrically heated irons, which are always maintained at the desired temperature without waiting to be reheated.

The sideboard, mantels and grilles are studded with 10-candle-power ground-glass globes, which shed a soft, mellow light and give a very pleasing effect.

The Electrical Exposition.

The Electrical Exposition will be held at Madison Square Garden, New York city, from May 2 to May 31, inclusive, a splendid list of exhibitors having been secured. Even should complications with Spain arise, the holding of the exposition will not be interfered with in any way.

Mr. Eugene F. Phillips, president of the American Electrical Works, Providence, R. I., was a New York visitor last week. No one in the electrical field numbers more friends than Mr. Phillips, and no one is busier at the present time filling orders for the fine product of his factories.

TOLD IN THE DYNAMO-ROOM—IX.

Since Ned Fairbairn had taken Bert's place as dynamo tender at the Centerville station, it seemed as if things had never run so smoothly. Ned seemed to have a faculty of always discovering little faults or defects before they became dangerous, and thereby often prevented serious damage. A sparking commutator could not be found in the station, excepting, of course, those of the arc machines, where the edge of the brushes showed just the faintest fringe of the greenish-blue sparks indicative of a well-cared-for machine. Ned had also designed several time and labor-saving devices which, unlike Bert's sometimes visionary schemes, were extremely practical and useful. One of these devices consisted of an automatic ground detector, whereby each circuit would instantly announce the fact of its being grounded. It consisted of half a dozen open-circuit batteries, a vibrating bell wound to about 150 ohms, and as many single-point switches as there were circuits. The bell and switches were mounted on a neat board, fastened on the wall near the main switchboard. To each switch button a piece of flexible cord with plug was attached, the other sides of all the switches being connected together by a wire which led to the bell and from there through the six cells of battery permanently to the ground. In the morning, before leaving the station each circuit was disconnected from the machines and one of the test plugs inserted in one side of the arc as well as incandescent circuits. As long as each line remained clear no current would flow through the bell coils, but as soon as any circuit became crossed or grounded, even by a wire of comparatively high resistance, the bell would announce the fact by its ringing. Since Dettmer was engaged to act as watchman during the day, it happened on several occasions that a ground was discovered some hours before it would have been known under the old practice of testing with the magnets just before starting. All these things were very much appreciated by Mr. Evans, and he looked upon Ned as a valuable acquisition to his force of employés. The arc lighting business of the company had been increasing steadily, owing to general revival of business, and when the City Council ordered some forty additional street lights, a rearrangement of the circuits became necessary.

"I think it would be a good plan to cut two circuits together and then run two machines in series, as long as one of the new circuits will not be fully loaded for some time," said Jim, one afternoon, when the subject was being discussed between himself and Ned.

"Yes, that is a very convenient plan, and is often resorted to where two or more circuits are not each loaded sufficiently for any one machine," replied Ned. "But I have often found much difficulty in running the machines in series when they are of the open-coil type."

"Why, I never heard of any particular difficulty over in Queen City, where they run two or three machines in series right along."

"You'll probably find that those dynamos have a closed-coil armature, in which case no trouble is experienced by proper adjustment. But, as I said, you take the open-coil type and the machines will flash, caused by the regulator 'pumping,' and I have known the current to vary from one to two amperes above and below normal."

"Then there must be some scheme to overcome the trouble," replied Jim, "because I am almost sure that over at Queen City they are running Thomson-Houston machines."

"It is just possible that you are right," spoke Ned, "because it is not impossible by any means. I have tried several schemes, and am sure I could make one of them work here."

"I wish you would tell me about them, so that I won't be so all-fired green if the question ever comes up."

"Why, I'll be glad to," said Ned. "In the first place, I found that by running one of the machines from 50 to 75 revolutions faster, most of the trouble was avoided. This was with two Thomson-Houston machines. I had the same results with Brush and Schuyler dynamos. The rationale of this is——"

"Hold on there, Ned, what in thunder is rationawl, or whatever you call it?"

"Ha, ha, excuse me, Jim, it merely means the *reason* or *explanation* of anything."

"Oh, I see," said Jim; "well, go ahead with your rationawl story. I think I can follow you."

"Well, as I was saying, the reason is that, since these machines have so few coils in the armature, they do not furnish what one would call an absolutely 'straight' current, but rather a series of impulses, following each other so rapidly as to be practically continuous. But when running in series and at the same rate of speed, they will get in step and break apart (like two alternators running on the synchronizing lamp), again causing the pumping. Now by running one machine a trifle faster, they do not get together for a long enough time to cause trouble."

(To be continued.)

SPEED GOVERNMENT IN WATER-POWER PLANTS.

READ BEFORE THE FRANKLIN INSTITUTE, PHILADELPHIA, DECEMBER 14, 1897, BY MARK A. REPLOGLE.

(Continued from page 215.)

The fourth element to be considered is gravity, the source of all energy or power that can be had from water. Its effect can be considered as a constant in reasoning about power-getting. Of course, it is variable within certain limits. A square inch of opening at the bottom of a vertical column of water will allow gravity in a given time to generate a number of foot pounds of power, and in direct ratio to its height. This power is absorbed in giving velocity to a stream of water an inch square and spouting a number of feet per second. Gravity has established an equilibrium in giving this velocity to the water. If the opening were increased the power generated would increase in like ratio. It is the duty of the turbine wheel to reduce the velocity of this water as nearly as possible to zero without changing its own speed. In so doing the power is transferred to the wheel shaft, where it can be carried to other points. With the exception of the small amount of power that is required to give a slow, downward movement to this vertical column of water, it can be said that the full effect of gravity is represented at the gate opening. Also, as soon as the opening is increased or diminished, there is practically the same increase or diminution in the amount of power represented by the volume and velocity of the water.

Again, if this column of water was extended in a horizontal direction from the top of the vertical column and the whole encased in a closed pipe or trunk, it can readily be seen that, when gravity operates on one square inch at the foot of the vertical column, it must put in motion the horizontal mass of water at the same time that it does the vertical mass. It is plain then that, while gravity has begun active operation as soon as the opening is made, its full effects will not be represented at the opening or wheel until the whole mass has been supplied with enough kinetic energy to give the necessary motion for the full spouting velocity at the gate opening. It is apparent that, while gravity is limited in the amount of power it can supply in a given time, it can be, and often is, further limited in its time of supplying power for governing purposes by the use of long pipes.

Considering the facts, that a change of load must be made before a governor can begin operating, that it requires time for a governor to perform its operation, that torsional and lost-motion effects are found in all gate riggings, that gravity must have time to do its work and may further be

obstructed by injudicious flume construction, and that the wheel is limited to a certain opening and need not necessarily run in the ratio of the amount of water passing through it, it follows that absolute speed can not be obtained in water-powers under heavy changes in load, as a change in load must necessarily change the speed before it is possible for gravity to furnish an increase in the supply of power. If there were no other factors government would be an impossibility, as a change of 50 per cent in load would instantly cause a change of 50 per cent in speed. But there are other factors, and, be it said to the credit of the great engineers who designed America's greatest water-power plant, these other factors were clearly understood, intelligently calculated and incorporated into its construction. They are visibly stamped in every part of its make-up. (Plate 2.) The first notable element is the size of the power units, 5,000 horse-power each. The second is the capacity of each unit for a storage of kinetic energy. It is absolutely necessary to have an accumulation of energy in reserve to tide over sudden fluctuations in load until gravity can make proper compensation. The designers of the great Niagara plant first determined the degree of government necessary or desirable, and from this as a basis the plant was constructed. The results show that the speed government is well within the limits for which the units of power were designed. It is evident that there is a great accumulation of energy in reserve when an instantaneous change in load of 1,000 horse-power causes only two per cent variation in speed, especially when the conditions are such that it requires about three seconds of time for gravity to increase the power supply to this amount.

There are several methods by which a reserve storage capacity can be maintained, but the one used at Niagara seems to be the simplest and most reliable. It certainly is the cheapest, being also purely mechanical. Reference is now being made to the balance-wheel or momentum effects of the revolving parts. It will be remembered that the armature, which is usually the lightest portion of a dynamo, is stationary in the Niagara Falls plant, while the field magnets, supported by an immense steel band, are the moving parts. It is also noticeable that the great shafts reaching downward to the turbines are of large diameter, being great tubes. This is for the purpose of giving high velocity to as much of the material as possible. A certain capacity for stored energy was necessary for good government, and it is safe to say that if this could not have been reached with the present weights and velocities of parts, more would have been added in the form of actual balance-wheels.

Plate 3 will serve to make clear the effects of power storage in the government of a water-power unit.

In Fig. 1 let *a* represent the power supply, *b* the water-wheel gate, *w* the wheel, *c* the turbine power, *d* the power storage, *e* the means of changing the load, and *f* the dynamos' power. It will be noticed that full 750 horse-power can be dropped off instantly by closing means *e*. The governor must operate at *b*, and it is safe to say that it can not be in active operation before one second has elapsed. Note the condition at the end of the first second after the 750 horse-power was dropped. When *e* was closed there was only one outlet for the power generated at *w*, and that was to increase stored energy *d* to dotted line *f'* during the second.

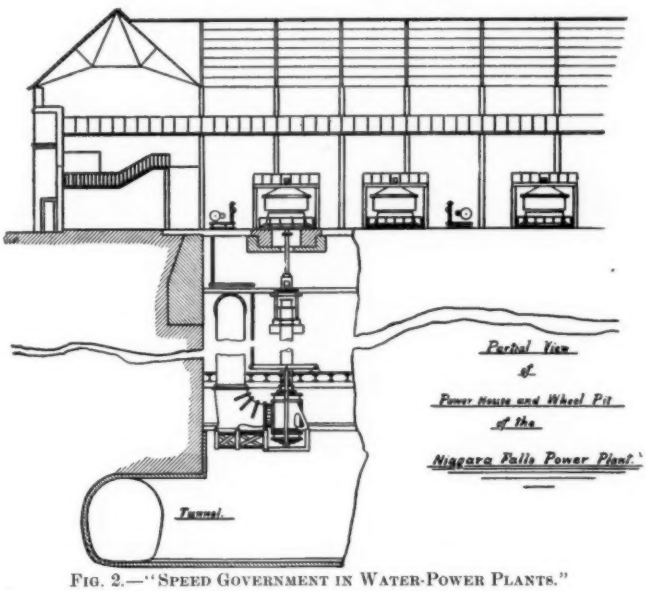


FIG. 2.—"SPEED GOVERNMENT IN WATER-POWER PLANTS."

This increase will theoretically raise the speed of the whole plant 100 per cent. If it were not for some other principles that step in this would be the actual speed at the end of the first second. In like manner, if the plant was running empty at normal speed, and 750 horse-power of load were addded instantly, the plant would theoretically be standing still at the middle of the first second. Here also other principles step in and change this result somewhat.

In Fig. 2 let A be the power supply, B the water-wheel gate, W the wheel, C the turbine power, D the power storage, E the means of changing the load, and F the dynamos' power. Please note that all the conditions are the same, except that there is 15,000 horse-power of stored energy in Fig. 2, while there is only 375 horse-power in Fig. 1.

If E is closed, 750 horse-power will be dropped off, and finds a place at F', increasing the volume of D five per cent, hence will theoretically increase the speed of power unit about two and one-half per cent by the end of the first second. This is also

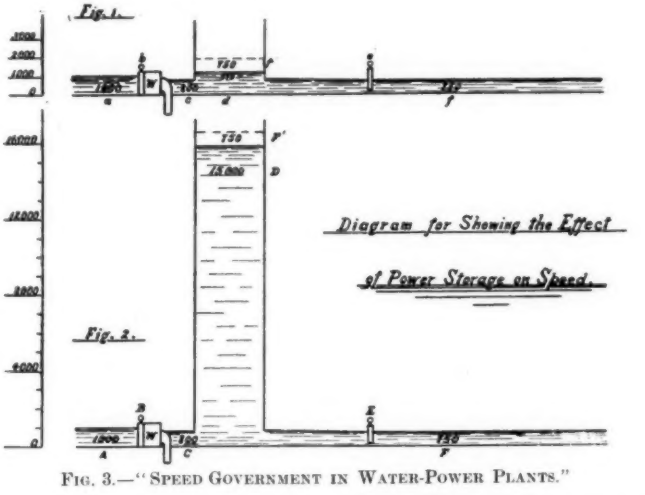


FIG. 3.—"SPEED GOVERNMENT IN WATER-POWER PLANTS."

lessened somewhat by the same principles that affect Fig. 1.

It can readily be seen that here is a means of preventing extreme changes in speed until gravity can perform its part of the work. Note the conditions in Fig. 2 if running at speed and a load of 750 horse-power were added. If the load were suddenly added it must be carried from the reserve power at D, using five per cent of it during the first second, hence reducing the speed about two and one-half per cent theoretically. It can readily be seen that the speed will continue to drop until balanced by new power generated at W after the governor has opened gate B. It can now easily be seen that D in any power plant can be increased until full change in load can be made with very narrow fluctuations in speed. In other words, every foot-pound of power or change in load can be intelligently provided for in the construction of a power plant, and variations in speed can be calculated for any change in load if the other conditions are known.

TABLE 1.

POWER STORAGE OF SOME WELL KNOWN PLANTS.

Name.	Units of Horse-Power.	Power Storage Capacity in Horse-Power for One Second.	Ratio of Power to Power Storage.
Niagara Falls Power Company	5,000	50,000	1 to 10
Sacramento Light and Power Company	1,000	8,000	1 to 8
San Joaquin Electric Company	450	9,000	1 to 20
Portland General Electric Company	600	3,000	1 to 5
Niagara Falls Paper Company	1,200	400	1 to 1/3

Table 2 will serve to give an idea how the power units of plants differ in the ratio of their power to their power storage. It is safe to say that if the other conditions were equal the possible government in their speeds would show equally as great a difference. Space forbids any further comment, except that each plant is desirous of good government.

TABLE 2.

APPROXIMATE LENGTH OF FEED PIPES IN EXISTING PLANTS.

Place.	Head.	Pipe.
Ithaca	94′	600′
Great Falls	4′	400′
Spokane	60′	600′
Brantford	30′	210′
Fresno	1,410′	3,800′
Niagara Falls	145′	200′

Ithaca Pipe contains 737,500, MV^2=11,800,000=338 horse-power of kinetic energy in pipe.

Table 2 is intended to show the horizontal lengths of feeder pipes of some of the existing electric water-power plants.

It is unnecessary to go into the details of the calculations, but the purpose is to show the possible effects of momentum if the water-flow was stopped as quickly as an electric load is sometimes dropped. Taking the first in the list, that of the Ithaca Street Railway Company, it is found that the pipe holds 737,500 pounds of water. Assuming that this column has a maximum velocity of four feet per second at full load, there will be a pressure of 11,800,000 pounds, or over 4,000 pounds per square inch at the water-wheel end of the pipe if the gates were closed as quickly as the load is dropped off. Since the static pressure is less than 50 pounds per square inch, and only a reasonable factor of safety provided, it is evident that a serious wreck would be the result of such a quick closing of gates. Yet such is necessary, theoretically, if even speed is desired.

(To be continued.)

THE REGULATION AND PROTECTION OF THE ELECTRIC MOTOR.

READ BEFORE THE CHICAGO ELECTRICAL ASSOCIATION, APRIL 1, 1898, BY HARRY H. CUTLER.

Electric transmission of power is fast becoming recognized as capable of almost universal application to all kinds of machinery. Scarcely a meeting of manufacturers, trade associations or engineering societies takes place where something of a favorable nature is not said about this rapidly growing and important industry. It can be truthfully stated, however, that the public is only just beginning to recognize the adaptability of the electric motor and that an enormous demand awaits it in the near future.

The introduction of the electric motor into general use has not been as rapid as is generally supposed. Seventeen years ago the writer took for the subject of his graduation thesis, "The Losses in the Transmission of Power by Means of Shafting and Belts." The results obtained were exceedingly interesting, and it might not be out of place here to mention some of them.

It was found that five-sixths of the power consumed by the engine was absorbed in the belts and shafting of the machine shop, and the very best result obtained with every machine in the shop running full, something which never occurs in practice, was an efficiency of about 30 per cent. The following deductions were then made from these results.

Attention is called to the saving which would ensue if power could be produced at each machine by means of a miniature steam engine or electrical machine, as illustrated by the low efficiency obtained in these experiments; the power to be transmitted by pipes in the form of superheated steam, or by wires conveying a current of electricity, instead of the present system of cumbersome and expensive shafts and pulleys. It has been known then for at least 17 years, and undoubtedly a great deal longer, that transmitting power by means of belts and shafting was expensive and uneconomical, and a remedy was pointed out at that time which is just being recognized to-day as good practice, and yet it is safe to say that nine-tenths of our mills and factories are still wasting unnecessarily enormous amounts of money by clinging to this antiquated practice of belt transmission. This is what is meant by the assertion that an enormous demand is in store for the electric motor.

We now see motors not only fast displacing belts and shafting, but also operating many kinds of machine tools, traveling cranes, hoists and elevators, pumps, ventilating fans, printing-presses, mining machinery, dredges, street cars, railways, vessels, air-ships, implements of war, telescopes and scientific apparatus, and in fact almost every conceivable application of power.

Now there is one peculiar feature which comes up with each and every motor that is installed; namely, that a connecting link between the motor and what it is to drive must be provided which shall be adapted to the peculiar kind of work to be performed. This connecting link is the rheostat or controller, and the rapidly growing demand for these devices has given rise to what could almost be called the profession of rheostat engineering. By means of the rheostat or controller, the motor is started and stopped, its direction of rotation is determined upon, and the speed at which it shall rotate is varied at will.

The same motor which drives a pump would drive a fan, a printing-press or a line of shafting as well, but the proper type of rheostat to use for these various applications of power would be vastly different in each case. Generally speaking, there are but three kinds of direct-current motors —the series, shunt and compound-wound—and the best suited of these three types of motors is selected to do the work. The types of rheostats for controlling these motors, however, are so numerous that only a few can be mentioned in this paper.

By far the largest number of stationary motors in use to day are direct-current, plain shunt-wound, non-reversing and run at a constant speed. These motors are usually provided with motor-starting rheostats, whose resistance is in circuit only during the few seconds consumed in starting the motor. Simple as these rheostats are, great care should be taken in selecting the size and style best suited for the work.

A motor that is started and stopped but two or three times a day can be satisfactorily handled with a starting rheostat that would frequently be almost useless for starting and stopping a motor two or three times a minute. A rheostat arranged to start a motor under full load to the best advantage will not start a motor equally as well at 100 per cent overload. A rheostat satisfactory to the fire underwriters of Chicago is not necessarily adaptable to the New York authorities, and would be looked upon as unnecessary extravagance by the country trade. It is important, then, even in the very simplest cases, that the character of the work should influence the selection of the proper starter or rheostat; and when it comes to applying a motor to almost any other use than that of driving belts and shafting, this question becomes of still greater importance. Most stationary motors are operated at constant speed, but consumers of power are finding out that the speed of a motor can easily be regulated at will, and are calling for appliances which will accomplish this.

I can almost say that there is but one way by which the speed of a motor, of direct current, can be changed, and that is by changing the voltage across some of its parts or windings. There are a great many ways to accomplish this. The simplest, but unfortunately the most unsatisfactory, way of reducing the speed of the motor is to reduce the voltage across the armature by inserting external resistance in series with it. This method is uneconomical on account of the current absorbed by the rheostat, and also destroys the self-regulating property of the motor. The speed of a shunt-wound motor varies approximately with the voltage across the armature or brushes; with external resistance in series with the armature, the speed will vary to a much greater extent for the following reasons: When the load on the motor is increased the current C must increase. This increase of current can only occur by a decrease in speed, which lowers the counter electro-motive force of the armature, thereby permitting more current to flow. But the current, of course, has also increased in the rheostat, while the resistance R of the rheostat has, unlike the armature resistance, remained the same; hence, since $C = \frac{E}{R}$ we see that the electro-motive force E across the rheostat must be increased in some way, in order to allow more current to flow. This increase can be derived only by slowing down the armature and reducing its counter electro-motive force. A very slight increase in the load when external resistance is in series with the armature will then often actually stop the motor entirely. Such cases as this have been so frequently causes of complaint from customers that it would appear that the effect of external resistance in series with the armature is not at all well understood by either users, owners or salesmen of electric motors in general. The prevailing opinion seems to be that a speed regulator of the above type can be set so that the motor will run at a certain speed, independent of the load. In proof of this assertion, many orders can be shown from some of the largest manufacturers of motors in the country, calling for a certain number of steps in the regulator to give a corresponding number of fixed speeds for the motor.

Another method of changing the voltage across the armature is to operate the motor on a three-wire system, and connect the armature across the outside wires for high speed and between the neutral and one of the outside wires for low speed. This method wastes no current, and causes the motor to assume a definite speed independent of the load.

Still another method which is ideal, so far as the motor regulation is concerned, is to connect the armature across a variable number of storage batteries, thus obtaining any desirable speed over wide ranges. Another method consists in so winding the armature that the coils may be changed from parallel to series, which can be accomplished in several ways.

Altering the voltage across the field of a motor also affects its speed, but in exactly the opposite way from that caused by changing the voltage across the armature. To increase the speed of a motor we can decrease the strength of its field, and there are many ways of doing this. The simplest and one of the best is the insertion of external resistance into the shunt-field circuit. This method is not only very simple and inexpensive, but, unlike the armature regulation through resistance, it wastes comparatively nothing in heat and allows the motor to assume the desired speed and maintain that speed independent of the load.

Motors are to be had of nearly all the large builders which will operate satisfactorily with a field variation of 50 per cent in actual ampere turns. The same result is frequently obtained by using a compound-wound motor, winding the series fields in separate sections and cutting out these sections one by one by means of a special switch. At least one manufacturer goes so far as to use so many of these field sections that their resistance is sufficient to prevent more than the proper amount of current from flowing on closing the circuit without using any external resistance whatever. The series windings are then cut out one by one as the armature revolves. A very powerful starting torque and a wide range of speed is thus obtained. This method, however, will not regulate the speed independent of the load, as the field strength can not be kept constant. It is applicable, therefore, chiefly to cases where an attendant is constantly on hand, as in the case of elevators, cranes and hoists.

One more method of varying the field strength consists in throwing the windings of the field cores into series connection for high speed and series multiple for slow speed.

Motors are sometimes regulated by means of using a separate generator for each motor, and varying the voltage of the generator by means of its field rheostat. This method is known as the Leonard system, and gives perfect regulation over a wide range.

We have now before us a long list of methods from which to choose the system of regulation best adapted for the work at hand. One of the simplest and best is that frequently used for regulating motors, driving fans and blowers, by means of so-called compound-speed regulators. No large office or school building is now considered up to date which is not provided with artificial ventilation, which can be regulated at will.

The motors which drive the fans are so belted or geared to the fan, that when the fan is operating at the average speed desired, no external resistance of any kind is in circuit. To reduce the speed, the rheostat lever is moved to the left and resistance is cut into the armature circuit, and to increase the speed, the lever is moved to the right and external resistance cut into the shunt-field circuit.

To select the proper sized motor

and to determine upon the proper speed to run the fan, requires an accurate knowledge of and experience with fans, air ducts and the laws of moving air. This is another subject which has not been reduced to a science by fan builders. Some builders always use a series-wound motor for driving fans, and others have adopted the shunt-wound motor. When it is not necessary to vary the speed of a fan, the series motor is probably preferable as being simpler, but for driving large fans, where speed regulation is always desirable, the use of a plain shunt-wound motor and a compound-wound regulator appears to be the best practice.

In proportioning the resistance for a fan-regulating rheostat, it must be borne in mind that the power required varies directly as the third power of the speed, and not directly as the speed as in driving shafting and machine tools. A regulating rheostat for a fan is therefore designed on entirely different lines; even the contacts and mechanism are different, because a fan is never started and stopped at frequent intervals during the day, and a cheap button front will do the work satisfactorily.

(To be concluded.)

INSULATION AND CONDUCTION.

READ BEFORE THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, MARCH 23, 1898, BY REGINALD A. FESSENDEN.

(Continued from page 218.)

The idea that electrical flow in solid conductors might also be a simple handing on from one atom to another suggested itself nearly a decade ago to Professor Lodge. That brilliant and careful reasoner and experimenter, who has cleared up so many patches of scientific jungle, gives a very clear description of the manner in which this would happen if such were the case. I can not do better than quote him, as it will show how well this idea agrees with all the facts then known but one.

"But if we are not satisfied with this vague analogy, and wish to penetrate into the ultimate nature of heat and the mode in which it can be generated, then we can return to the consideration of a multitude of oscillating and colliding particles, moving with a certain average energy which determines what we call the temperature of the body. If now one or more of these bodies receives a knock, the energy of the blow is speedily shared among all the others, and they all begin to move rather more energetically than before; the body, which the assemblage of particles constitutes, is said to have 'risen in temperature.' This illustrates the production of heat by a blow or other mechanical means. But now, instead of striking one of the balls, give it an electric charge; or, better still, put within its reach a constant reservoir of electricity from which it can receive a charge every time it strikes it, and at the same time put within the reach of some other of the assemblage of particles another reservoir of infinite capacity, which shall be able to drain away all the electricity it may receive. In practice there is no need of infinite reservoirs; all that is wanted is to connect two finite reservoirs, or 'electrodes,' as one might now call them, with some constant means of propelling electricity from

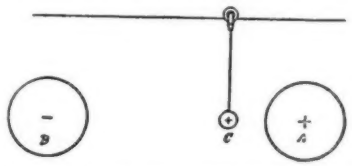


FIG. 1.—"INSULATION AND CONDUCTION."

The Ball C, having touched A and got A+ charge, is repelled and moves over to B, where it gives up its charge, takes up A— charge and moves back to A.

one to the other; i. e., with the poles of a voltaic battery or a Holtz machine.

"What will be the result of thus passing a series of electric charges through the assemblage of particles? Plainly the act of receiving a charge and passing it on will tend to increase the original motion of each particle; it will tend to raise the temperature of the body. In this way, therefore, it is possible to picture the mode in which an electric current generates heat.

"But although this process may be used as a possible analogy, it can not be a true and complete statement of what occurs; for it is essentially the mode of propagation of sound. Sound travels at a definite and known velocity, being a mechanical disturbance handed on from particle to particle in the manner described. But heat, being some mode of motion, must also be handed on after some analogous fashion, so that when heat is supplied to one point of a mass it spreads or diffuses through it. It is difficult to suppose the conduction of heat to be other than the hanging on of molecular quiverings from one to another, and yet it takes place according to laws altogether different from those of the propagation of the gross disturbance called sound. The exact mode of conduction of heat is unknown, but, whatever it is, it can hardly be doubted that the conduction of electricity through metals is not very unlike it, for the two processes are the same laws of propagation; they are both of the nature of a diffusion, they both obey Ohm's law, and a metal which conducts heat well conducts electricity well also."

I have said, "with all the facts then known but one." This because, as mentioned in the abstract given above, there seemed to be no good evidence for the view that there was any connection between the conduction of sound and of electricity. The reason for this lay in the fact that very few determinations had been made of the velocity of sound in the pure metals, though a considerable number had been made on alloys and commercial materials.*

Consequently, no general law could be discovered, though it can not be doubted but that, had the formula for the relation between Young's modulus and atomic volume discovered by the writer† been known at that time, this evidence, of a still more intimate connection between sound, heat and electricity, would have been discovered by Dr. Lodge.

The formula referred to is:

$$\text{Young's modulus} = \frac{78 \times 10^{12}}{(\text{atom. vol.})^2}.$$

Hence, it is possible to predetermine the velocity of sound in wires by the formula:

Velocity in centimetres per second $= \frac{883 \times 10^4}{\text{atom. vol.} \times \sqrt{\text{density}}}$, and the electric resistivity is given roughly by:

Resistivity $= 45 \times 10^{-9} \times$ atom. vol. $\times \sqrt{\text{density}} \times$ valency.

This formula possesses a general interest, inasmuch as it would seem that while the strain in the dielectric is propogated with the velocity of light, i. e., $\sqrt{k}\ u$, the actual electricity in the wire were handed on with the velocity of sound, and is proportional to $\frac{\sqrt{k}}{\mu}$. The significance of this will be treated of elsewhere.

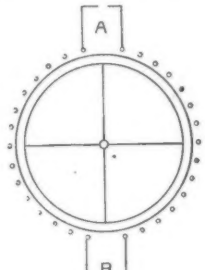


FIG. 2.—"INSULATION AND CONDUCTION."

Suppose a wheel, with elastic spokes and a heavy rim bound outside with a band of horsehair, the horsehair rubbing against a series of violin strings mounted parallel to the axis of the wheel, as shown in Fig. 2. Suppose each violin string has mounted upon it a small metallic bead charged with electricity, so that when the strings vibrate the beads can touch. Then, on grasping the wheel at B, after a time depending upon the elasticity and mass of the wheel, a spark will be seen at A, but the actual velocity with which the electricity moves round the circuit of violin strings will depend upon the elasticity and mass of the strings. In passing, we may note several things:

1. That for this analogy to hold at all, the atoms must be charged even in a conductor not carrying current; which is significant when taken in connection with the fact pointed out by the writer in the papers above referred to, that if we calculate the tensile strength, rigidity and Young's modulus on the assumption that these effects are due to charges on the atoms, we get results agreeing very closely with experiment.

2. That in a circuit having many atoms in the cross-section the energy could be handed on without actual contact by electro-dynamic processes.

3. That if one part of the circuit were composed of violin strings tuned to a different note-period from the other we would get effects similar to those of thermo-electricity.‡

4. That the reversal of the point of greatest drop of potential in a circuit of air and carbon from the + to the — electrode as the pressure is reduced may be due to the fact that, as shown by the beautiful experiments of J. J. Thomson, the molecular conductivity of air at low pressure is extremely high, the electrode heated thus depending upon whether the solid conducts better than the gas, or *vice versa*.

5. That this same formula would also be applicable to a diffusion phenomenon, and indeed the presence of valency in the formula makes it exactly analogous to that for the diffusion of heat. Moreover, Roberts-Austen, in a series of striking experiments, has shown that diffusion can take place in solids at ordinary temperatures. If a current be, however, a diffusion, it may be shown that for fairly large current densities the atoms must move several centimetres per second, and we might, therefore, expect interpenetration when brass and zinc terminals are joined. But this does not occur to any considerable extent. We may also take it as an electrolytic diffusion, as is suggested by J. J. Thomson in his "Dynamics Applied to Physics and Chemistry," but in this case, even assuming the theory suggested by him to account for some atoms preferring a plus to a negative charge, I find it difficult to imagine the manner in which the atoms could be charged and discharged at the surface of the conductor. It is to be noted that in gases the phenomenon of diffusion, sound velocity and heat conductivity are all linked together.

(To be continued.)

*I am here moved to again call attention to the fact that an immense amount of physical experimental work is misdirected. It is no doubt quite gratifying to ascertain, after several years laborious work, that a particular piece of brass or steel, of not very definitely known composition and in a quite indefinite physical state, has a temperature coefficient of expansion expressed by five significant figures, but such information must be considered as pieces of philosophic virtú, intrinsically worthless, but possibly possessing a value by reason of their uniqueness and associations. I have pointed out elsewhere (Journal of the Franklin Institute) that, at the present time, in spite of the fact that much has been done, notably by Matthiessen, Roberts-Austen and others, we have not at present any data in regard to 90 per cent of the more important properties of the simpler metals used in the arts. The importance of having a standard state for solids; of a central bureau to furnish pure materials in a standard physical state to experimenters, and the exclusive use of such materials by experimenters, can not be overestimated.

† *Electrical World*, August 22, 1891; *Science*, July 22, 1892.

‡ Compare the analogous problem of two portions of gas of different densities in a closed ring tube, and junctions heated. Neuman, Jahrberichte f. Chem., 1874, p. 15.

Electrical Review

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SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week.

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The patriotic sentiment of the electrical engineering fraternity is shown by the following incident: Two young engineers recently formed a firm in New York city for the practice of their profession and both joined the Naval Militia. Last week callers at their office were confronted by this sign on the door: "Both gone to war. Don't know when we will be back."

An indirect lightning fatality occurred the other day in a western state. A bolt of lightning struck two mules and one of them fell on a boy and killed him.

An inventor advertises an automatic car strap and asserts that its use will make standing in street cars a comfort. Our guess is that he has never had the experience of sitting on a strap from the Battery to the Polo Grounds in New York.

The total toll connections—messages for which there was an extra charge—of the licensees of the American Bell Telephone Company for the year 1897 was 24,200,000. The toll business of these telephone companies is constantly increasing.

The telectroscope, a new device for seeing around corners, which has already been described in the ELECTRICAL REVIEW, has created great interest in Europe. It is said that the inventor is to receive $1,000,000 if he will exhibit the device at the Paris Exposition in 1900. This, of course, is important if true, and we hope the telectroscope will live up to the remarkable claims made for it.

THE SCOPE OF ELECTRICAL ENGINEERING.

Striking evidence of the wide scope of electrical engineering and the industrial expanse covered by electrical development is afforded in the pages of technical weeklies and monthlies devoted to other branches of engineering. Of the papers devoted to the fields of steam, mechanical, mining and marine engineering, machine construction and design, are to be found issue after issue containing articles on electrical questions which merge into the field covered by the individual paper in question. The vital conclusion to be drawn is that the title, "electrical engineer," covers but one of the several engineering branches with which the electrical specialist must be competently familiar. The electrical engineer of to-day, to properly deserve his title, must possess a composite brain which will stand him in good stead in any one of a hundred situations.

A PAPER BY MR BRUSH.

In the issue of *Science* for April 8, 1898, will be found a comprehensive abstract of a paper by Charles F. Brush, on "The Transmission of Radiant Heat by Gases at Varying Pressures," read before the American Association for the Advancement of Science, August 10, 1897. It is a matter for regret that Mr. Brush, of late years, has chosen to devote his well known talents and energies to the investigation of physical and scientific phenomena not purely electrical. In this instance, however, the electrical worker, especially he who is interested in the higher development of the incandescent lamp or the X-ray tube, may find instruction; for Mr. Brush states that his investigation of the question forming the title of his paper is a part of a general study of the properties of high vacua, in which he has long been engaged. Perhaps we may hope that Mr. Brush is working up to an ultimate result from which his electrical brethren of the past may derive practical aid; for he concludes his paper as follows: "This interference of mixed gases is a very interesting phenomenon, and seems to warrant the careful investigation which it is my intention to give it."

The series of articles by Mr. Walter Wyckoff, which have been appearing in *Scribner's Magazine*, wherein he relates his experiences as a member of the great army of the unemployed, are among the most interesting of any dealing with labor difficulties that have appeared. Nothing of the sort has been written about the electrical industry, the chief reason perhaps being that the industry is so young. It would be undoubtedly of vast benefit to the working man in the electrical field were his needs, failings and dues made known to the world at large by an observer as keen and competent as Mr. Wyckoff. It has been remarked that the emergency always produces the man, and it is only fair to infer that when such a real need, aside from the interesting and picturesque character of the question, is created that the proper man will stand forth.

A VALUABLE AUXILIARY ENGINEERING CORPS.

If war against Spain is declared by the United States and the emergency arises, the Massachusetts Institute of Technology at Boston could turn out a regiment of men especially valuable to the government authorities. The general public is not aware of the fact that during the freshman year at "Tech" a military drill of three hours a week, under the instruction of a regular army officer, is a part of the required course of study. Consequently every man in the three upper classes has had for one year a military training superior to that of the ordinary militiaman. In addition, these men are half-fledged engineers familiar with shop work, and the theory involved in electrical, steam, mechanical, chemical and marine engineering and naval architecture. They would undoubtedly form a valuable auxiliary to our regulars should the occasion arise. There are now nearly 1,200 students at the Massachusetts Institute of Technology.

The importance of being able to distinguish visually the positive and negative wires in a distributing system at a distance from the center has long been recognized, and, in some instances, provided for. In one case a difference in the braided covering on the insulation, and in another a difference in the color of the insulating core, affords the desired information at a glance. Such a distinction is equally desirable in complicated systems of steam or water piping, so that the supply and return pipes may be instantly known. On at least one of our modern battleships there is a mass of piping on the under side of one of the decks in which the supply and return pipes are marked with red and black stripes on the white paint, respectively. There is a great similarity of practice here, and it would be interesting to know whether the steam engineer borrowed the idea from the electrical engineer or *vice versa*.

Spring is here. The official omen is in evidence. Open street cars were put in service in New York city last Saturday.

Wall Street and the Electrical Stock Market.

Transactions in the securities markets during the past week were exactly what might have been expected in view of the imminence of a crisis in the political situation. On Monday and Tuesday the stock market waited for the President's message to Congress on Wednesday. The postponement until Monday of the transmission of the message caused a sharp rally late Wednesday afternoon. During the rest of the week it was almost entirely a "waiting market," with professional traders practically the only buyers or sellers. At this writing indications point to the near ending of the suspense which has depressed the market for weeks. Within a few days we shall know whether it will be peace or war.

General Electric sold down from 33¼ on Monday to 32, and up again to 33¼ on Wednesday, later fluctuating fractionally. Transactions were rather light. Considerable progress is making in the negotiations for an arrangement with the preferred stockholders. Various reports have been published about the proposed plan, but it can be stated on good authority that they are premature. Conferences have been held in Boston last week and this week, and an official announcement is expected shortly.

Western Union followed the course of the general market, selling between 85 and 87½. The collateral trust 5's sold at 108½.

North American was exceptionally quiet. The total week's sales were under a thousand shares at 5¼@5⅜. American Telegraph and Cable stock changed hands at 90 to 91. Edison Electric Illuminating, of New York, sold at 119 on Friday, a decline of 5 points from the last previous sale; the consolidated 5s were steady at 114½, and the 1st 5s at 109½. Edison of Brooklyn stock was lightly traded in at 107.

There were no transactions in electrical stocks during the week on the Philadelphia Stock Exchange. In Boston, Bell Telephone opened at 247, sold down 4 points Tuesday, regaining all the loss subsequently, and closing at 248. Erie Telephone ranged between 64 @ 64½; General Electric preferred was quoted at 80 bid, offered at 90, and New England Telephone sold at 126 @ 127, closing at 125 bid, 130 asked.

The following statement was filed with the Commissioner of Corporations of Massachusetts by the Erie Telegraph and Telephone Company under date of January 1, 1898: Assets—Stocks and bonds, $8,507,266; cash and debts receivable, $250,895; total, $8,758,161. Liabilities—Capital stock, $4,800,000; debts, $3,630,500; reserves, $94,369; profit and loss, $233,292; total, $8,758,161.

The following dividends were declared during the week: Chicago Telephone, monthly, 1 per cent, payable April 5; New York & New Jersey Telephone, quarterly, 1½ per cent, payable April 15; United Electric Securities Company, semi-annual, on preferred stock, $3.50, payable May 2 to stockholders of record April 20. The last dividend was declared in February, 1896.

The annual statement of the Thomson-Houston Electric Company, made to the Secretary of State of Massachusetts, shows the following for 1897: Assets—Buildings, $571,396; machinery, $449,713; cash and debts receivable, $14,557,732; manufactured merchandise, etc., $828,376; patent rights, $3,395,050, making a total of $19,802,267, a decrease of $607,082 over 1896. The liabilities were—Capital stock, $10,000,000; profit and loss surplus, $9,802,267.

Wall Street, April 9. RAY.

Where Spain Bought Her Mines.

A London cable dispatch says that the English firm of Lattimer, Rhodes & Clark, electrical engineers, sold a lot of submarine mines to the Spanish Government in 1887 and 1888. The mines were made under the direction of J. P. Gibbons, a former sergeant of engineers and fort inspector of torpedoes. He says he believes the "Maine's" first explosion was caused by what is technically called a ground mine, containing 500 pounds of guncotton, several of which were manufactured for Spain. He has experimented with these mines largely at Portsmouth, and says that, once laid, they retain their properties for 50 years. Gibbons asserts that it is absolutely impossible for them to explode accidentally, as the electric connections for their explosion can be made only by the manipulation of a complicated keyboard, especially devised to prevent accidents. Three keys are necessary, which are always kept in the possession of different officers, and even if an outsider obtained possession of them, it would be impossible to manipulate the keyboard without instructions. Gibbons further says the mines and their connecting cables are numbered, and he asserts he would be able to identify them if any part is secured.

Look Out For Spanish Spies!

A prominent wire manufacturing company in New York city, which recently has received a large number of orders from the government for its wires and cables, reports to the ELECTRICAL REVIEW an occurrence which should be a warning to other electrical manufacturers now engaged on government contracts. The company in question was rushing out a lot of single-conductor torpedo cable which had been tested, and was being reeled up for shipment. The quick eye of one of the company's inspectors caught a flaw in the cable and the work of reeling was stopped. Examination revealed the fact that the cable had been cut, obviously by design. The break was repaired and the cable shipped, after an annoying delay.

Owing to the rush work on hand for the government this factory has been working day and night, and, as a consequence, a number of extra employés have been taken on. The officers of the company believe that a Spanish sympathizer or spy cut the cable, and at once began an investigation. Measures have been taken to prevent a recurrence of such actions.

Westinghouse Apparatus for the Navy.

A Pittsburgh dispatch, dated April 10, states that the Westinghouse Electric and Manufacturing Company will begin to ship at once to the Brooklyn Navy Yard a lot of generators, motors, dynamos and other apparatus. They are to be used for the installation of electric power and light plants on board the merchantmen, old monitors and coasting steamers now being equipped by the government for service in case of war with Spain. The order is for $682,000 worth of such material, and the company will receive a bonus of $25,000 for prompt delivery. Shipments will be made every day this week.

A Government Order for Telephones.

The Pennsylvania Electric Company, of Marietta, Pa., has received a large order for telephones from the War Department, to be used for all the forts, coast defense and signal stations along the Atlantic coast. The company received instructions to rush the order. This is quite a compliment to the Crescent telephone apparatus, as no doubt other makes were considered before the order was placed. The Crescent telephone embodies late improvements.

Why Our Bluejackets Can't Sleep.

"It was a constant round of drills and picket duty on our ship at Dry Tortugas after the 'Maine' was blown up," said a recently returned naval officer to an ELECTRICAL REVIEW man. "We were 70 miles at sea, with no sources of news, and we didn't know when a Spanish fleet would heave in sight. We all worked harder than ever, chiefly to keep our minds occupied. My division included what I considered the crack gun crew of the ship, and the way those boys handled the rapid-fire guns was something delightful.

"After a week or two of this unusual drill, which developed a proficiency truly amazing, I noticed that my pet gun crew became listless and a trifle slow in their work. They seemed to lack heart. Sharp words and reprimands only served to stir them up temporarily. I was at a loss to account for this change, and set out to discover the reason. I called up an old gunner's mate and asked him what he thought was the cause.

"'Don't know, sir. The boys is all right, sir—only I guess they don't sleep very well, sir.'

"More puzzled than ever, I resolved to keep my eyes open. Jackie is a queer bird at times. The next night I was officer of the deck and had the mid-watch. Along about two bells I thought I heard voices forward and went to investigate. There was that whole blessed gun crew stowed away as comfortably as possible on the deck, looking out to sea. Some were lying down with with their eyes glued on the water, others had their elbows on the guard rails with their chins on their arms looking out over the waves.

"I went aft and sent for one of my men, and asked him why he wasn't below in his hammock where he belonged.

"'Well, sir, we ain't a-goin' to get caught asleep down below in our hammicks like those "Maine" boys, sir. We owe the Spanish something for that and something for ourselves. We are all tryin' to be first to sight a Spaniard, sir, so we're watchin'—that's all, sir.'

"Here was the explanation of my gun crew's listless performance. They were working as hard as men could work and getting little or no sleep. It wasn't fear that kept them awake—not by a long shot. It was simply the desire to be the first to sight a Spanish ship and the hope of getting the first shot at her. The suspense of inaction was what worried my boys."

The Electric Arc as a Telephone.

A paper by Hermann Th. Simon, in *Wied. Ann.*, Vol. 64, page 233, a translation of which appears in our London namesake, describes some exceedingly curious experiments, which show that the electric arc is capable of acting either as a telephone transmitter or as a receiver. Herr Simon first observed accidentally in an arc light a peculiar crackling noise, which he traced to the influence of an intermittent current supplying an induction coil, and flowing in a conductor, which ran for some distance parallel to the leads of the electric arc.

Experiments with the rotating mirror failed to show that the electric arc was in a state of vibration, but this was explicable on the hypothesis that the alternating induced current superimposed on the steady current producing the arc, caused so little variation in the light that the changes could not be perceived by the eye. The alternating current, however, was quite capable of producing changes of temperature in the arc, which expanded and contracted the gases sufficiently to generate sound waves perceptible to the ear. Conversely, it was found that when sound waves were allowed to fall on the arc, variations of the current were produced, which were capable of reproducing the sounds in a distant microphone.

The following arrangement was devised to show these effects. The primary of a small step-up transformer was connected up in the circuit of the electric arc; a microphone and battery were put in circuit with the secondary of the transformer. When the end of a sounding tuning-fork was placed in contact with the microphone the same note was heard distinctly at the electric arc. Whistling, knocking, singing, and even speech were transmitted and distinctly given out with all the most delicate variations of tone by the electric arc. With loud tones of a certain pitch the notes given out by the arc were accompanied with a hissing sound. To collect the notes from the arc a glass funnel is held opposite to the arc and connected to the ears by two tubes.

Herr Simon has calculated the variations of density of the gases which would be produced by the changes of the current, and found that they lie within the limit fixed by Lord Rayleigh for audible sound waves, and he fairly concludes from this that the notes heard in the arc are due to these variations of density.

When the arc is lengthened the sounds emitted become essentially louder and more distinct. This is due to the fact that, the resistance of the arc being greater, a greater fraction of the work of the current is expended on the arc and a larger volume of gas is heated.

In order to show that the electric

FIG. 1.—TABER & MAYER'S DESK TELEPHONE SET.

arc is capable of acting as a telephonic transmitter, the microphone in the above described arrangement is replaced by a telephone, and the sound waves are concentrated on the arc by a funnel. Speech, singing, whistling, thus directed on the arc, are heard distinctly at the telephone. The explanation of this phenomenon is plain, when it is remembered that the resistance of the arc varies with the density of gases through which the current passes; the variations of the resistance will produce corresponding variations of the current which, by lateral induction in the transformer, are transmitted in an intensified form to the telephone.

We do not recommend this invention for commercial use; the language transmitted through the present telephone is usually heated enough; at least, there is no necessity for passing it through an electric furnace.

LITERARY.

The ELECTRICAL REVIEW has received the initial number of the "American Electrical Directory," which is the successor to the "Standard Electrical Directory." Mr. E. L. Powers, who is well known throughout the electrical field, is the publisher, and the work he has turned out in this case is of a highly commendable character. The directory is typographically excellent, and is conveniently arranged in a neat form. The electric lighting statistics contained in this first issue are especially valuable, the information covering plants owned and controlled by private capital as well as those owned by municipalities. The directory will appear quarterly, and can be obtained from the Electrical Review Publishing Company, Times Building, New York, at $4.00 per year.

Taber & Mayer's Telephone Apparatus.

In the accompanying illustrations are shown two types of telephones manufactured by Taber & Mayer, 185 Franklin street, Boston. In Fig. 1 is shown a desk set, which is strong and well made. The base is weighted with a casting, which is cored out to receive the induction coil and terminals. These are protected by a fiber disk, which is covered with felt to prevent noise and scratching when used on the desk. The transmitter is adjustable to any angle, and a four and one-half-foot silk four-conductor cord is attached to each set. Fig. 2 illustrates a long-distance telephone made in the very best manner and finely finished. All the joints are soldered, and the magneto bell is guaranteed to ring over 10,000 ohms.

Taber & Mayer have recently supplied the State House in Boston with 18 of the desk telephone sets illustrated herewith, and have also equipped several of Boston's new public school buildings. They have also just closed a contract to furnish an elaborate switchboard for B. F. Keith's new theater, and have taken an order to

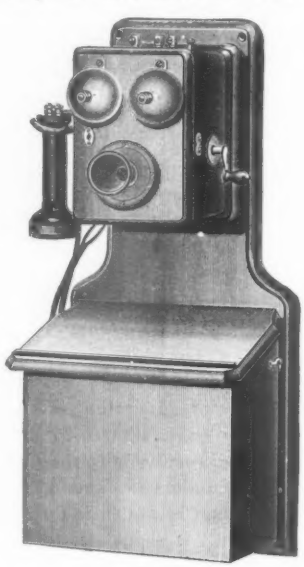

FIG. 2.—TABER & MAYER'S LONG-DISTANCE TELEPHONE.

supply a telephone system for the Gardner plant of Haywood Brothers and the Wakefield Company.

Capt. Edmund L. Zalinski, U. S. A., retired, the inventor of the dynamite gun which bears his name, is in Roosevelt Hospital, New York city, suffering from grip and bronchitis. He was removed to the hospital last week from his own rooms in the Century Club at 7 West Forty-third street.

Dr. Bleyer on Death by Electricity.

TO THE EDITOR OF ELECTRICAL REVIEW:

An article which appeared in a recent number of your journal under the heading, "Death by Electricity," from the pen of Dr. S. W. Hedley, of London, I carefully looked over, and must say that I failed to learn therefrom anything original, either from investigations or suggestions on the part of the author. The whole matter contains nothing but a rehash of what others have done. I therefore can not find a single peg or plea —to hang it upon—for his having written this article except for reviewing some of the already known works of others. As father and one of the first experimenters on electrocution, a few words in answer to this review will be acceptable to your readers, especially to those who have earnestly studied and watched the progress and facts on these lines.

I am of the opinion, from a series of my early and late investigations, that the causes of death by electricity are due to various conditions present in each individual case, and therefore each must be taken into consideration always on its own merits as found. Death may be due to many causes, and not in any two cases, perhaps, do criminals die from the same electro-physiological result.

In the New York ELECTRICAL REVIEW, April 24, 1895, an article by myself appears, headed "Dynamic Apoplexy as a True Cause of Death by Electrification," etc. Therein I first showed that we were laboring from a delusion that the surgeon's knife alone was the true executioner. From what is set forth in that article as evidence based on most scientific lines, this fallacy must fall to the ground and prove our fallacious standing in the whole matter. It was, I admit, rather a startling revelation to me at first, when I learned these claims, but soon were dispelled by a few crucial experiments which I carried out and found that one of the chief causes of death was due many times to dynamic apoplexy when a lethal dose of current is applied to a criminal according to our state laws.

Any one who has witnessed or experimented in this line of work must agree with these electro-physiological facts. I am also convinced that all criminals do not die from dynamic apoplexy, but from some other complications in connection with the laws of physiology which every individual according to his state may possess while undergoing a death penalty. In commercial accident,

one can readily see how deaths may take place; all depends upon how the current was passed.

Much could be said pro and con on this matter, but space in such a journal as yours is of value of which I do not care to rob you. Suffice it for me to say that we have all much to learn on this matter of electro-physiology, pathology and microscopy after death by electricity has been duly achieved. Most truly yours,

DR. J. MOUNT BLEYER,
F. R. A. M. S., LL. D.,
Professor National College Electro-Therapeutics.
New York, April 1.

The Palmer, Mass., Central Station to be Rebuilt.

The New England Engineering Company, of Waterbury, Ct., have been retained as consulting engineers for the rebuilding of the electric light plant of the Central Massachusetts Electric Company, of Palmer, Mass., which was recently burned.

The plant was burned to the ground, being a complete loss, on March 17, and the superintendent and engineer were badly burned. The New England Engineering Company were notified and at once started to get dynamos there, and, by making arrangements with several mill owners to furnish power to run them, succeeded in getting the lights running in Palmer on Sunday, March 20.

The contract for new electrical machinery has been placed with the General Electric Company, who did everything possible to help get things running again, even chartering a special locomotive to take the car load of dynamos from Lynn to Boston, so as to avoid any possible delay. By doing this the car was in Palmer early on Saturday morning.

The contract for an engine, which is to be used only in case of high or low water to help out the water-wheels, has been placed with the Slater Engine Company, of Warren, Mass.

The Inventor of the Shaft Governor for Steam Engines.

The question as to who was the inventor of the shaft governor now commonly used on high-speed steam engines was recently raised by an engineering publication, with the result that a great deal of interesting information was drawn out. Among others who have been heard from is Col. Gardiner C. Sims, the well known engineer, who was connected for a great many years with the Armington & Sims Engine Company, Providence, R. I. Colonel Sims, by means of data preserved at the time, establishes his claim to the fact that he was the first mechanical draughtsman in this country to take up the subject, and, in fact, is the only person living thoroughly acquainted with its early history. It will also be remembered that Colonel Sims designed and built the first high-speed engine for Mr. Edison. It was the success of this machine which established the reputation of Armington & Sims, and the credit for being the pioneer in this field belongs to Colonel Sims. The engine which he built for Mr. Edison was sent to the Paris Exposition, then to the Paris Opera House, and is now successfully running in Amsterdam, Holland. Colonel Sims has shown by memoranda made at the time that he designed the shaft governor in 1872, and, after making several sets of drawings, finally applied for a patent, which was granted on October 28, 1873.

A Strike in the Bullock Shops.

The Bullock Electric Manufacturing Company, of Cincinnati, Ohio, has had a strike on its hands, a few of its employés having stopped work on account of a fancied grievance. The places left vacant by these men were promptly filled, and the Bullock company believes that it has mastered the situation and will control it without further difficulty.

MR. FRANK E. HEALY, PRESIDENT ILLINOIS ELECTRIC COMPANY.

MR. CARL KEITH, TREASURER ILLINOIS ELECTRIC COMPANY.

MR. L. K. CUSHING, SECRETARY ILLINOIS ELECTRIC COMPANY.

Illinois Electric Company.

Probably few new enterprises are started with fairer prospects of success than the business of the above named company, if energy and experience, integrity and ambition can be considered important factors in such an undertaking. Three young men, each with an experience of years in all the details of a mercantile business, have associated themselves for the purpose of carrying on a general electrical supply business, and while each member of the firm will probably be recognized as an old acquaintance, a few words touching their personality will not come amiss at this time. Mr. Frank E. Healy, president of the company, was, one might say, brought up in the supply business. Starting seven years ago with the Central Electric Company, he remained with that firm continuously until now, occupying during that time various positions, which would give him an insight into the general business and make him thoroughly familiar with even its smallest details.

The knowledge of Mr. L. K. Cushing, secretary of the company, was also gained mostly through his seven years' connection with the Central Electric Company, although some four years' work in the operative branches of the electric light and telegraph field has made him familiar with the actual requirements in that line. Beginning in 1888 as dynamo man with what was then the Chicago Arc Light and Power Company, Mr. Cushing worked there in various departments until 1890, when he accepted a position as assembler with the Central Electric Company. Promotion came rapidly, first to city salesman, then to traveling salesman. In 1892 the apparently brilliant prospects of the telautograph induced Mr. Cushing to join Professor Gray's force of experts, but in 1894 he again accepted the position as manager of the shipping department of the Central Electric Company, where he remained until now. During the past 10 years few have been or are engaged in the electrical trade who have not met or heard of "Lem" Cushing.

Mr. Carl Keith, the energetic treasurer of the new concern, during the past four or five years has probably gained a clearer insight into the intricacies of buying and selling than many older heads in the business. Shortly after leaving college he joined the Central Electric's forces, and working in the capacities of salesman, purchasing agent and general stockman, he obtained a knowledge of quality and prices which will undoubtedly be of immense advantage to his company. Mr. Keith is a typical Chicagoan, having lived there all his life. This, however, has not prevented him from becoming thoroughly acquainted with the trade through visits on either side, and as a popular, wide awake young business man is equaled by few.

The ELECTRICAL REVIEW extends to the new firm best wishes for its welfare, success and uninterrupted prosperity.

The Wonders of the Telegraph.

[*From the Electrical Review, London.*]

The following marvelous instance of what the electric telegraph is now capable of doing appeared in yesterday's *Standard*:

HARDING—On March 19, at Chefoo, China, the wife of John Reginald Harding, M. I. C. E., of a son. (By telegram.)

The city of Chicago has appropriated $150,000 for the extension of its municipal lighting system. Ten 150-light arc machines of the Western Electric Company's manufacture have been ordered by the city.

CENTRAL POWER PLANT ON BOARD SHIP VERSUS DISTRIBUTION OF POWER.

READ BEFORE THE AMERICAN SOCIETY OF NAVAL ENGINEERS BY PROF. WM. S. ALDRICH.

(Continued from page 213.)

Should the power required at any point be developed elsewhere in a central plant and transmitted to that point for direct utilization? Or should such power be generated by a steam engine on the spot and further transformed into compressed air, water pressure, or electricity, as may be required for application at such point? It will be seen that the whole problem resolves itself largely into a question of the distribution of power. The distances for such distribution are so short on board ship that there is practically no necessity for considering any of the so-called line losses in power transmission work. The transformation losses, however, are vitally important. In any case these should not exceed, if they should ever be found to equal, the present losses from mechanical friction alone in the many auxiliary steam engines scattered throughout the ship. Losses incident to the transformation of energy vary slightly with the load, but in a different manner for each of the working fluids noted. Again, such losses, if confined to a central power plant, should not even approach those of similar losses in the transformation of energy in the different power generating steam engines scattered throughout the ship. The question of the storage of energy is not so important on shipboard as might, at first sight, appear. Compressed air probably admits of the readiest storage for use on naval vessels, with the least disastrous results from shot and shell. A storage battery for electricity or a hydraulic accumulator are practically out of the question. The former requires no system of storage for use on shipboard; the latter almost imperatively requires such storage for maintained distribution of energy.

Looking for a moment at the steam engine required for such a central power plant, it will be found to be advantageous to subdivide the plant into generating units. Representative types of compound engines, now so extensively used for such subdivision, are chiefly of the self contained type. There would be little use for single or paired simple engines for such a central plant.

If steam-power is converted into electricity for all of the operations required on board ship, it will be interesting to note different characteristic features of such installation. It would be beyond the range of the present paper to investigate fully the comparative advantages and disadvantages of each of the systems of power distribution—steam, compressed air, water pressure and electricity. The present purpose is merely to have in mind some definite system for a discussion of the steam generating plant required, should all of the power be thus developed in a central plant.

Consider a central power plant made up of compound condensing steam-engine units, each a duplicate of the other, with all parts of the same size and respectively interchangeable, and certain advantages will at once be apparent; namely, the plant may be operated at all times in such manner that each engine is loaded to its full normal capacity; variation in load may be met by throwing in or out one or more of such steam-engine units. The ranges of power for variations of load will in no case be so great on any one engine as in the several steam engines used to drive the scattered auxiliaries.

In the matter of equalizing the load on such a power plant driven by duplicate steam-engine units, it is seen that the conditions are ideal and extremely favorable when applied to electric generation. The plant may be operated at a nearly uniform load day and night, respectively. The electric light load at night may be offset by additional electric motor load during the activities of the day. Also, certain pumping machinery can be operated at any time by electric motors during the day or the night, so that these may be thrown in or out to compensate for otherwise large variations in load. One in charge of such a central electric power and lighting plant on board ship would be able to so operate it and obtain a load curve which would be the admiration and envy of central station managers on shore. Station indicators would so indicate terminal conditions on the circuits that the most efficient operation of the plant would be obtained at all times.

It is quite impossible to treat of this question without further treading upon the debatable ground respecting the merits and demerits of the different methods of power distribution. In all cases, however, the following economic features should be carefully weighed for any given or specified service: Cost of installation; running expenses, involving pay of attendance, cost of coal and water, oil and waste; depreciation and repairs.

In this connection it is important to notice the results of Mr. H. A. Foster's analysis of the tests of 22 different power plants.* These included manufacturing establishments, electric light stations, pumping engines, etc. Plants above 200 horse-power show a remarkable uniformity in fixed charges; namely, interest on first cost, depreciation, taxes and insurance. The operating expenses gradually decrease in plants from 200 to 1,000 horse-power, above which capacity the operating expenses seem to remain remarkably uniform and quite irrespective of load variations. The large electric stations supplying many smaller industries are scarcely affected by the instantaneous load changes in one or more of these particulars.

Other features of the electrical system are its thorough adaptability to all of the work required on board ship, its extreme flexibility, and withal it is possessed of the best system of distribution by means of insulated wires in conduits making it the least liable to derangement in action. The distributing mains may be safely and securely run through watertight bulkheads and compartments. The transmission line losses are practically negligible for the short distances under consideration. The distribution losses on the several branch circuits alone require detailed consideration. The direct current is, of course, to be used in all cases. In such a system it is possible to secure a higher maintained efficiency of operation of the plant than any other system, and this is really the point to be desired in any such installation. In the electric system, also, it is possible to control with known certainty distant motors for various auxiliaries, and such control may be from one central point.

The electric system alone admits of such subdivision of the generating plant into equal and interchangeable engine-dynamo units. The advantages of this on shipboard are too apparent to require discussion.

There is not now an auxiliary on board ship which can not be operated with certainty, efficiency and economy by electric motors. All pumps, fans, blowers, hoists, shifting and steering gear, turret gear and gun mounts may be so operated, and are every day reaching towards this system of operation. The same may be said of the air compressors required for refrigerating purposes.

(To be concluded.)

TABLE I.—SHOWING EXAMPLES OF RATING ELECTRIC POWER PLANTS ON THE HEAT-UNIT STANDARD, REDUCED FROM 1897 REPORT OF COMMITTEE ON DATA OF NATIONAL ELECTRIC LIGHT ASSOCIATION.

Station No. in 1897, Report N. E. L. A.	Pounds feed water per hour, actual efficiency.	Temperature of feed water, Fahrenheit.	Steam pressure (gauge). Pounds per square inch.	Total heat B. T. U. in feed water per pound	Plant ratings. Kilowatt hours per 1,000 pounds of feed water, actual efficiency	Plant ratings. Kilowatt hours per 1,000,000 B. T. U. at belt efficiency.	Type of engines	Rating at best efficiency, water per I.H.P. hour	Method of driving dynamos.	Dynamos daily output. Watt hours.	Kind of service. Daily.
1	2	3	4	5	6	7	8	9	10	11	12
6	23.50	...	160	.....	42.60	.....	Vertical, triple expansion, four-valve	15	Direct Connected.	900,000,000	Incandescent, 24 hours.
14	26.65	100	115	1,100.0	37.55	34.14	Tandem, compound condensing. Double tandem, compound non-condensing. Cross-compound.	17.5	Belted to jack shaft. To Dynamos.	124,000,000	Arc and incandescent, 22 hours.
1	37.50	110	125	1,009.5	26.30	26.45	Vertical compound, non-condensing, four-valve.	25.8	Direct Connected.	23,600,000	Incandescent, 24 hours.
10	38.10	..	110	.....	26.30	.....	Compound condensing. Simple non-condensing.	28.5	Belted to dynamos.	3,400,000	Arc and incandescent, 24 hours.
2	39.30	110	125	1,009.5	25.50	25.26	Horizontal cross-compound condensing. High speed, single-valve, automatic.	25.7	Belted to dynamos.	1,400,000	Incandescent, 6 to 22 hours.
7	45.00	180	135	1,053.90	22.00	21.06	Simple non-condensing. Compound non-condensing.	28.0	Belted to dynamos.	13,000,000	Incandescent, 24 hours.
8	45.00	...	160	.....	22.00	.....	Cross-compound condensing. Tandem compound.	28.0	Direct connected. Belted to dynamos.	12,400,000	Arc and incandescent, averaging 17 hours.
5	47.50	108	125	1,013.50	21.00	20.72	Simple non-condensing. Compound non-condensing.	29.1	Belted to dynamos.	15,600,000	Arc and incandescent, 24 hours.
9	53.07	140	120	1,080.70	18.80	17.39	Single-acting, compound condensing. Simple automatic non-condensing.	28.0	Belted to dynamos.	2,700,000	Arc and incandescent, 24 hours.

TABLE II.—PERFORMANCE OF THE ELECTRIC LIGHTING PLANT OF THE GOVERNMENT HOSPITAL FOR THE INSANE, AT WASHINGTON, D. C., BASED ON THE HEAT-UNIT STANDARD, FROM RESULTS REPORTED BY CHIEF ENGINEER GEORGE W. BAIRD, U. S. N.

	Small plant.	Large plant.
Date of making test	Nov. 19, 1896.	Dec. 1, 1896.
Number of Kilowatts per hour	57.20	108.90
Pounds of feed water pumped into the boilers per hour	2,285.00	4,481.70
Mean temperature of feed water, in degrees Fahrenheit	129.9	125.9
Steam pressure in boilers, in pounds per square inch above atmosphere	93.42	92.33
Total heat in one pound of steam, being the heat required to raise one pound of feed water from its temperature to that of the steam at the boiler pressure and evaporate it into steam at that temperature (Kent's Tables)	1,085.7	089.5
Plant ratings:		
(1) Kilowatt hours per 1,000 pounds of feed water	25.03	24.30
(2) Kilowatt hours per 1,000,000 British thermal units supplied to the system	23.06	22.30
Engines, cross-compound, rope belted to dynamos. Diameters, inches	10½ and 16½	13 and 20½
Stroke, inches	12	15
I. H. P. developed, when loaded	103.84	197.07

*"Transactions of the American Institute of Electrical Engineers, Vol. XIV, "Variations in the cost of steam power," by Mr. H. A. Foster. Paper presented at the annual convention, July 28, 1897.

LEGAL NOTES.

THE VAN DEPOELE TROLLEY DECISION REVERSED.

In the suit of the Thomson-Houston Electric Company against the Union Railway Company, of New York city, the United States Circuit Court of Appeals has reversed Circuit Judge Lacombe's decision, in which he granted an injunction pending final hearing in the case, restraining the railway company from using certain overhead trolley car appliances to which the plaintiff claims exclusive right under the Van Depoele trolley patent. The Union Railway Company is using the Walker Company's apparatus, and the officers of the latter company state that under the decision the right to make and use the underrunning trolley is now no longer limited to the General Electric and Westinghouse companies and their licensees.

This decision, the Walker Company understands, is final and closes litigation extending over five years. The patent owners announce, however, that the decision is not final.

Suit has just been instituted by the Westinghouse Electric and manufacturing Company against the Wagner Electric Manufacturing Company under the Lange – Shallenberger double-throw switch patent. The bill was filed in the Southern District of New York and prays for injunction and damages.

Manufacturers of insulated wires and cables are convinced that the era of prosperity has arrived.

A New Transformer.

The central station manager, using the alternating current for light or power distribution, has from year to year become more and more exacting in his demands for the most efficient apparatus, and the manufacturer, as a rule, is prepared to produce newer and improved designs, as may be practicable. The past year or two have seen great improvement in transformer design, until to day it would seem that the limit of commercial practicability has been reached. Keeping the internal losses of a transformer at a minimum is, of course, the most essential feature in its design. The iron or core losses should especially be kept low, as these losses are constantly going on, whether the transformer is loaded or not, and to obtain a high all-day efficiency these losses must be kept as small as possible. The copper loss, due to the resistance of the transformer coils, does not become effective until the load is put on, and while, perhaps, not as important as the core loss, should nevertheless be kept at a minimum. Next to high efficiency, close regulation is another important feature to be considered. The lower the copper loss and magnetic leakage the closer will be the regulation.

In designing its Type A transformer, the Moloney Electric Company, of St. Louis, claims to have met to the highest degree the above-mentioned requirements, combining a high all-day efficiency and close regulation with a superior mechanical design. Their all-day efficiency varies from 85.1 per cent in the 600-watt size to 94.3 per cent in one of 25-kilowatt capacity. The curves given herewith show these, as well as efficiency of intermediate sizes. In tabulating the all-day efficiency, a load of five hours and no load during 19 hours was assumed. Great attention is paid to the proper testing of each transformer before being shipped. A pressure of 10,000 volts is applied between the two coils and between the coils and case. The windings will withstand a potential difference three or four times greater than the transformer is intended to carry. The transformers are not, it is said, subject in any marked degree to the aging of the iron, which is so often found in certain qualities. Owing to its perfect ventilation and the disposition of its coils, this transformer can be safely overloaded 25 per cent of its capacity for several hours. This is of great advantage where it is necessary or desirable to connect up a greater number of lights than the transformer is designed to carry, as in church or residence lighting, where the heavy load lasts only a comparatively short time.

While the transformer is comparatively new in the field, a number of them have been in daily operation for over a year, meeting in all respects the demands of the most critical user.

American Tool Works Company.

The Davis & Egan Machine Tool

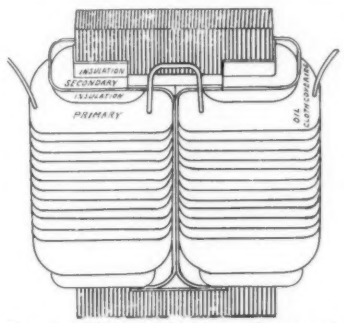

FIG. 1.—MOLONEY ELECTRIC COMPANY'S TYPE A TRANSFORMER.

Company, of Cincinnati, Ohio, has been reorganized, and its name changed to the American Tool Works Company. The capital has been increased from $500,000 to $1,000,000, the increase being six per cent, cumulative, non-voting stock, of which $200,000 has been subscribed for and issued. The balance of the preferred stock will not be issued at present.

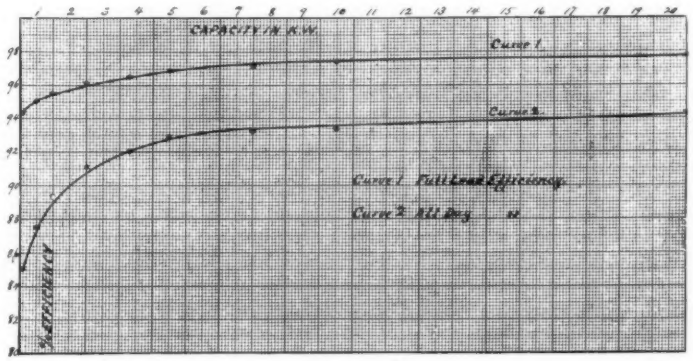

FIG. 2.—EFFICIENCY CURVES OF MOLONEY ELECTRIC COMPANY'S TYPE A TRANSFORMER.

The steadily increasing foreign business of the company has necessitated its enlargement, and the change of name is made in the interest of this same foreign business. The stock of the Davis & Egan company has paid 12 per cent annually since the company was formed from the old Lodge-Davis concern. The last act of the Davis & Egan directors was the declaration of the regular quarterly dividend of three per cent. It is practically assured that Mr. Charles Davis will retain the presidency of the company.

Captain Griffin's Volunteer Corps of Electricians.

Capt. Eugene Griffin, U. S. A., retired, first vice-president of the General Electric Company, has organized an auxiliary corps of electricians and electrical machinists, which will serve in the army or navy, or both, in case war against Spain is declared. The engineer corps of the army has been short of electrical experts, whose services are now in great demand in the preparation and planning of submarine mines and torpedoes. Captain Griffin recognized this deficiency of skilled workers, and, with the permission of the Secretary of War, formed his plans, and has carried them out to success. He has obtained the names and the day and night addresses of a large number of skilled workmen in the employ of the General Electric, Westinghouse and other electrical concerns in New York and the New England states. This information has been sent direct to General John M. Wilson, U. S. A., chief of the engineer corps, who now has it on file. A number of these volunteers are already at work in New York Harbor, Boston and Philadelphia. Within a day or two more will be sent to the southern coast.

In an interview, Captain Griffin is quoted as saying:

"Before the force could go to work, a considerable amount of apparatus and supplies was needed, as the War Department has not been able to accumulate these in sufficient quantities. I have been of some assistance in locating the apparatus and supplies in the possession of private corporations and companies. This can be procured at a moment's notice. I may add that I have had the most cordial co-operation and support from every one to whom I appealed."

Mr. John I. Sabin, of San Francisco, the telephone magnate of the Pacific Coast, is enjoying a rest of a few weeks in the cities of Boston, Providence and New York.

"Modern Switchboards."

What is far and away the handsomest and most artistic trade publication the ELECTRICAL REVIEW has ever seen is that just issued by the Cutter Electrical and Manufacturing Company, Philadelphia, under the title of "Modern Switchboards." The book is a quarto volume, bound in cloth and consisting of 222 pages. The switchboard and the appliances used thereon are fully described, and there is an historical résumé of early practices and expedients, indicating the advance recently made in this class of electrical apparatus. Data on improved methods of construction are also included. In the preparation of the book the Cutter company acknowledges its indebtedness to Messrs. Luther Stieringer, Albert B. Herrick and W. H. Tapley, contributions from all of whom appear. The book is an unusually valuable one, and is well worth the price, $3, for which it may be obtained from the Cutter Electrical and Manufacturing Company.

Massachusetts Institute of Technology.

The thirty-third annual catalogue of the Massachusetts Institute of Technology, of Boston, for 1897-8 has been received by the ELECTRICAL REVIEW. The splendid training in electrical engineering afforded by this well known institution is familiar to most of our readers. The course of study is thoroughly up to date, and of a practical as well as theoretical character. Two new courses of lectures have recently been added to the curriculum, one upon the industrial applications of electro-chemistry and one relating to the economics of corporations. There are now 1,198 students at the institute.

Electric Power In a Buenos Ayres Factory.

Walker, Bailey & Company, of Buenos Ayres, are installing the first outfit of electric motors for supplying all of the motive power in a factory, that has ever been installed in that country. The plant is for a weaving factory, and is to be driven by Lundell electric motors of such power that each motor will drive six machines. There are instances where it is advisable when putting in electric motors to fit each machine with a separate motor, but in this instance the machines are always in operation; hence it is economical to install on the plan adopted by Walker, Bailey & Company.

ADVANCE INFORMATION

New Telephone and Telegraph Companies.

SNOW HILL, MD.—The Worcester Telephone Company has been incorporated by C. J. Purnell, W. S. Powell, W. F. Johnson, J. P. Moore and others; capital stock, $2,500.

ASHEBORO, N. C.—E. A. Wiles, of Randleman, N. C., is said to be contemplating the establishment of a telephone system in this place.

EDDYVILLE, KY.—Jas. Clark is considering the construction of a telephone system.

SPARTA, N. C.—The telephone line will be extended from this place to McMinnville within a short time.

KIBBIE, MICH.—Kibbie Telephone Company has been incorporated, with a capital stock of $10,000.

MCFALL, MO.—The McFall Telephone Company has been incorporated by C. O. and H. J. Patton, Lewis Schultz & Company, William A. Patton, Jr., and others; capital stock, $1,000.

WAUCOMA, IOWA—The Union Electric Telephone Company will build a line from Austin to Spring Valley.

WEST PLAINS, MO.—The West Plains Telephone Company has been incorporated by D. W. Reese, Charles H. Gale, F. O. Hines and others; capital stock, $20,000.

GRAFTON, W. VA.—The Wickwire Telephone Company has been organized, with Dr. Alex. Leeds, president; Richard Wood, vice-president; Z. B. Knotts, secretary, and Edward Luzatter, general superintendent, and is constructing its lines.

FRANKFORT, TENN.—The Cumberland Telephone and Telegraph Company and the Great Southern Telephone Company have consolidated; capital stock, $3,000,000.

NEW BERNE, N. C.—The Henderson Telephone Company has purchased the Newberne telephone system, and will expend several thousand dollars in improving same, putting in new switchboards, cables, etc.

ATWOOD, KAS.—The farmers of Rawlins County are considering the advisability of putting in a telephone line between Atwood and Achilles, by way of Chardon, so that they may communicate more readily with the markets.

BLOUNTVILLE, TENN.—A telephone line is being constructed for the People's Telephone Company, between this place and Fall Branch.

FESTUS, MO.—The erection of a telephone line between this place and Hillsboro is contemplated. It is to have a connection with the telephone lines now running to Morse's mill and De Soto.

DAYTON, OHIO—The American District Telegraph Company has been incorporated; capital stock, $30,000.

Electric Light and Power.

MALVERN, ARK.—C. W. Turner may give information concerning construction of an electric light plant.

LOUISVILLE, KY.—J. E. Powell, electrical engineer of the United States Treasury Department, Washington, D. C., has prepared plans for the proposed $20,000 electric light plant to be placed in the Federal Building at Louisville.

LOCKPORT, N. Y.—The Niagara, Ontario & Lockport Power Company and the Lockport Water and Electric Company will build a power canal from the Niagara River to Lockport, a distance of about 20 miles.

SONOMA, CAL.—The Sonoma Electric Light Company will construct an electric plant.

PIEDMONT, W. VA.—James C. Fredlock has received contract from the city for electric lights and will establish a plant.

CLINTON, KY.—The Clinton Water and Light Company will consider propositions for the construction of its proposed waterworks and electric light plant, to cost, complete, $10,000 to $12,000.

MANOR, TEX.—The Manor Artesian Well Company will establish an electric light plant.

GREENWOOD, S. C.—Walton & Wagner, Rome, Ga., have received contract for establishing waterworks, and the General Electric Company has received contract for installing electric light plant.

GLENS FALLS, N. Y.—The Glens Falls, Sandy Hill & Fort Edward Electric Railroad Company will erect a new power-house.

STUTTGART, ARK.—The Stuttgart Water and Electric Company will assume the franchise granted to Charles Williamson, and arrange for the construction of plants and lighting and water supply.

MCCOMB, MISS.—An electric light plant will be established.

HARRIMAN, TENN.—D. W. Thomas, city clerk, may give information concerning construction of an incandescent light plant.

CHARLOTTE, N. Y.—George P. Goulding may give information concerning construction of an electric light plant at an estimated cost of $10,000.

JERSEY CITY, N. J.—The De Lery Light Company; capital, $500,000; corporators, Joseph B. De Lery, Casper H. Eicks, Otto R. Saint and Henry P. Chilton, of New York, and Edgar L. Jones, of Newark.

PORT JERVIS, N. Y.—The Port Jervis Light and Power Company will construct an electric plant to cost about $50,000.

BERLIN FALLS, N. H.—The Northern Electric Company, recently incorporated, will build an electric light plant.

New Electric Railways.

CUMBERLAND, MD.—The Cumberland Electric Railway has been granted right of way for an extension from Narrow's Park to Alleghany Grove.

WEST ONEONTA, N. Y.—The West Oneonta & Lawrence Railway Company has been incorporated by Frank Gould, Parker Wilson, Albert D. Getman, Walter S. Whipple, Harry W. Lee, David S. Peet and R. W. Strong to build five miles of electric railway between the villages named; capital stock, $750,000.

KIRKWOOD, MO.—The St. Louis & Suburban Railway is doubling its electric line from this place to Meramec Highlands.

EAST ORANGE, N. J.—The Third-Rail Block System Company, to manufacture a patented third rail for trolley roads; capital, $100,000; corporators, Louis E. Walkins and J. Warren Wiley, of Springfield, Mass.; C. D. Chase, of Northampton, Mass., and Howard K. Wood, of East Orange, N. J.

MUSCATINE, IOWA—The electric light and street railway plant, which has been under the management of W. A. Seevers, has changed ownership. The new purchaser, Harry W. Huttig, has taken charge, and there will be an entire change in the management. The consideration was over $50,000 above the bonds.

New Incorporations.

JERSEY CITY, N. J.—The Duryea Motor Vehicle Company has been incorporated. The incorporators are William P. Williams and Charles L. Spencer, of New York, and Charles H. Hall, of Jersey City.

CLEVELAND, OHIO—The Cleveland Electric Light Enlarging Company is authorized to manufacture and deal in photographic enlargements on $10,000 capital stock. The incorporators are Jacob J. Denemark, Harry C. Mason, Frederick L. Taft, W. T. Black and A. M. Austin.

SALT LAKE CITY, UTAH—Articles of incorporation of the Salmon City Electric Light and Power Company have been filed with the Secretary of State. The capital stock is $10,000, and the directors named are G. G. Shaver, William F. Boxwell, William Peterson, W. T. Robinson, R. W. McBride and Ed Mingle.

MADISON, ME.—Somerset Telephone Company has been incorporated for the purpose of operating a telephone exchange for the towns of Madison, Anson and North Anson, with $2,000 capital stock. The officers are: President, Thomas H. Spear, of Anson, Me.; treasurer, Jennie L. Spear, of Anson, Me.; certificate approved, March 15, 1898.

ROCKFORD, ILL.—The Rockford Railway, Light and Power Company has been organized by F. A. Poor, M. B. Poor and R. S. Clements, to construct and operate street railways; capital stock, $250,000.

Montauk Multiphase Cable Adopted by the Gamewell Company.

As will be observed from the letter printed below, the Montauk Multiphase Cable Company, of New York city, have recently closed a very important contract with the Gamewell Auxiliary Fire-Alarm Company, under which the multiphase cable will be used for combining thermostatic fire-alarms with the Gamewell system of fire-alarm telegraphs.

As the readers of the ELECTRICAL REVIEW know, the Montauk Multiphase Cable Company recently originated and developed a new type of cable which gives to property-owners and insurance companies a protection against loss by fire when used with any interior service, heretofore unknown. The chief advantage of these cables lies in the fact that they are not required to be specially installed in order to afford a means of discovering dangerous heat or flame and to give automatic notification at any point or points desired where such a flame exists. Although installed for purposes of an entirely different character, every fractional part of their wire or cable installed under the Montauk system is continuously thermostatic, and consequently results in giving protection from loss by fire, which is an advantage equally beneficial to the property-owner and the insurance companies.

The Gamewell company, as is well known, is the parent of the present extensive fire-alarm system which is in use in over 700 of the largest cities of the United States, and the Montauk Multiphase Cable Company is certainly to be congratulated on the fact that the conservative Gamewell company has recognized the merits of their product and will hereafter use it in connection with their own apparatus. In a few words, the closing of this contract means that the Gamewell Auxiliary Fire-Alarm Company is willing to rely upon the burning of the Montauk cable to close the circuit and automatically call out the fire department through the Gamewell system. The letter referred to appears below:

Joseph W. Stover, President.
Geo. F. Milliken, General Manager.
H. F. Bender, Treasurer.
Albert H. Cross, Superintendent.

GAMEWELL AUXILIARY FIRE-ALARM COMPANY.

EXECUTIVE OFFICE,
19 Barclay St.,
NEW YORK, March 30, 1898.

MONTAUK MULTIPHASE CABLE COMPANY,
100 Broadway, New York City.

GENTLEMEN: Herewith we send you formal acceptance of your proposal for furnishing us with your "multiphase electric cables."

After full consideration we have come to the conclusion that we will find, through the use of your cable, something long known to be desirable, but hitherto impracticable; viz., a device which we can safely use for the purpose of combining thermostatic fire-alarms with our auxiliary system of connection with public fire-alarm telegraphs.

Yours truly,
(Signed) JOS. W. STOVER,
President.

The Question of Overhead Wires.

The objection frequently raised to the building of overhead telephone and telegraph lines is due, as a rule, not to the presence of the wires at a certain distance above the street surface, but rather to the supports to the wires—the poles. Many persons consider that poles, while actually occupying but little space, fill the street, and if both sides of a street on which it is proposed to build a new line are already occupied by lines of other companies, the objection becomes even more pronounced. Under these circumstances, the building of a new line means the use of larger poles in order that the wires of the new line shall clear those of the old; to those already opposed to overhead lines this is particularly objectionable.

Except in large cities, where it is really more economical to place wires under ground owing to the immense number of wires in service, overhead construction must be followed. It is not feasible to place wires in subways in small cities and towns because of the comparatively few connections, which, if made by means of subsidiaries from the subways to distributing points or to terminal poles, requires a large outlay. The question which confronts companies desiring to build new systems is how to meet the objections of those opposed to pole-line construction to whom they apply for rights of way. One way in which to partly meet the opposition is to reduce the number of poles, making the spans longer between supports; another is to resort to housetop construction in the business sections of cities and towns. Neither of these plans can be followed, however, unless the wire used possesses great tensile strength, because of the additional strain occasioned by the increased distance between supports.

Standard pole-line construction calls for 40 poles to the mile, 132 feet being the average distance between poles. Notwithstanding this the Geneva Telephone Company, of Geneva, N. Y., through its general manager, Mr. F. S. Bronson, certifies to the satisfactory workings of bimetallic wire under great strain in the following letter:

We have over 150 miles of your (bimetallic) wire now in service, and the results so far have been very satisfactory indeed. We would not hesitate to recommend it for line wire for telephone service.

We are giving the wire a very severe test as to its tensile strength, as we have one span a little over 400 feet long over which we have 32 wires. We have pulled the wire in this section very tight, and so far we have not had a single case of line trouble in that remarkably long span.

The wire which is above referred to is of size No. 14, Brown & Sharpe gauge, weighing but 63 pounds to the mile. At the time Mr. Bronson wrote bimetallic wire had been in service on the Geneva Telephone Company's lines for nearly a year, which is satisfactory evidence of its durability.

Kindred.... ...Interests

The Partridge Carbon Company, Sandusky, Ohio, has just issued a very striking little catalogue, printed in two colors, of the Partridge self-lubricating motor, dynamo and generator brushes. A price list is also given and sizes for the different makes of apparatus. The little book will be in demand by all users of such apparatus.

F. E. Benton, of Stoughton, Mass., is the inventor and manufacturer of an ingenious automatic hand-strap for street and elevated railroad cars. Its chief advantage lies in the fact that its length is automatically adjustable so that a tall or a short passenger can stand and hold on to it in comfort. A number of prominent street railways have adopted the Benton hand-strap.

The Garton-Daniels Electric Company, of Keokuk, Iowa, have issued an attractive booklet describing the Garton lightning arresters which have achieved great popularity. These arresters are made in several types for central station, street railway circuits, street cars and stationary motor protection. The company has received the strongest kind of testimonials from prominent users and the sales of this apparatus are rapidly growing.

The American Electrical Works, Providence, R. I., is a company with an enviable reputation for the high grade quality of product. The American is one of the oldest and most successful wire and cable manufactories in the country, and its standing is excelled by none. The president of the company, Mr. Eugene F. Phillips, can name his friends by the score, and his treatment of customers is such that their numbers constantly increase.

The Electric Ozone Syndicate, Limited, 5 New Union street, London, E. C., England, is now prepared to supply commercial ozone generators built entirely of aluminum. The yield of ozone from these machines is said to be about 100 grammes per horse-power hour and they can be made of any size to produce from 100 to 1,000 grammes and more per hour. The generators are constructed under the patents of Mr. E. Andreoli, who is the managing director of the company. Among the principal applications for ozone are seasoning wood, bleaching, maturing wines and spirits, ventilating unhealthy buildings, sterilizing impure water, etc.

Users of miniature incandescent lamps will very readily appreciate the advantage of having a miniature lamp of a standard, reliable make that can be depended upon for efficiency and length of life. The Packard sign lamp, which is a miniature lamp about two inches long over all and one inch in diameter, fills the demand for a high-grade miniature lamp. It is mounted with regular Edison candelabra base, gives about two candle-power and burns four in series on 50 to 60 volts or eight in series on 100 to 120 volts. This lamp is carried in stock in Chicago in large quantities by the Electric Appliance Company, who always hold themselves in readiness to ship promptly any number of these lamps and the necessary sockets.

The Western Electric Company, Chicago and New York, has issued a handsome 36-page illustrated fan-motor catalogue printed in two colors. It is substantially bound in a neat and artistic cover. In the introduction they call attention to the desk and ceiling fans of the direct-current type, and also the desk and ceiling fans of the alternating-current type. A very clear and good illustration is given of the desk motor, showing the working parts in a sectional drawing, together with a complete description of the various details. Following this description comes the price list of the desk and

"MUNICIPAL OWNERSHIP VERSUS PRIVATE CORPORATIONS," WITH LEGAL AND EDITORIAL OPINIONS, TABLES AND COST OF LIGHTS, AS FURNISHED BY PRIVATE COMPANIES AND MUNICIPAL PLANTS, WITH LIST OF MUNICIPAL PLANTS THAT HAVE BEEN SOLD OR ABANDONED. CONTAINING, ALSO A COMPARISON OF ENGLISH AND AMERICAN GAS AND RAILWAY PLANTS." : : : :

BY M. J. FRANCISCO.

Fifth Edition, with statistics to date. Pamphlet form, 150 pages, price, 50 cents. Sent postage free, on receipt of price, by the

ELECTRICAL REVIEW PUBLISHING CO.,
TIMES BUILDING, NEW YORK.

CROFTON STORAGE BATTERY CO.
J. K. PUMPELLY, Manager.
VERY LIGHT BATTERIES
A SPECIALTY.
327 DEARBORN STREET, CHICAGO.

J. C. WHITE & COMPANY,
INCORPORATED.
ENGINEERS, CONTRACTORS,
29 BROADWAY, NEW YORK, N. Y.
EQUITABLE BLDG., BALTIMORE.

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PLANS, SPECIFICATIONS, REPORTS, DESIGNS.....
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No. 19 S. 11th St., ST. LOUIS.
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Quick-Break Switches.
If you desire the best, latest and most improved quick-break switch on the market, get the
"DEMARY."
They are all made of the best material that can be obtained, and all parts are standard in size.
These switches are made in one grade only, highly polished and lacquered
Send for Catalogue and Prices.
They will interest you.
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DIXON'S GRAPHITED WOOD GREASE
FOR TROLLEY CAR GEARS.
ABSOLUTELY PREVENTS NOISE AND DOES NOT OOZE OUT OF GEAR CASE.
"LASTS THREE TIMES AS LONG AS ANY OTHER LUBRICANT."
JOS. DIXON CRUCIBLE CO., JERSEY CITY, N. J.

DIRECT-READING AMMETERS
OR
VOLTMETERS,
Like cut, reading from 0 to 10, at $1.50 each. 0-25 at $5.00 each.
Cherry Electric Works,
25 & 27 3d Avenue, NEW YORK.

COMMUTATORS
ALL KINDS. COMMUTATOR SEGMENTS ASSEMBLED READY FOR USE. ARMATURES REWOUND.
NEW, REFILLED, REPAIRED. Write for Prices. F. E. HOMER & CO., CLEVELAND, OHIO.

brackets fans, each fan motor having full page illustration, the speed, the voltage, the current consumption, and the shipping weight being given at the foot of the illustration. In a similar manner a detailed sectional drawing of the direct-current ceiling fan is given together with a comprehensive description and following it is the price list and illustration of a complete fan ready for operation. Six pages of the catalogue are given up to the description of alternating-current desk and ceiling fans. The Western Electric Company is the agent for the Tuerk alternating-current ceiling fan. There are three pages of the catalogue devoted to battery fans and the last two pages give a complete list of the accessories necessary for installing fan motors of different types; viz., flexible cord, attachment plugs, receptacles, etc. This catalogue covers all the details and gives one all the information that could be asked in regard to fan motors.

The Crofton Storage Battery Company, Chicago, which makes a specialty of very light batteries, is filling several orders for vehicle equipments, where a minimum of weight is of course most desirable. So far the batteries are reported as giving very satisfactory results, taking in consideration the small weight of the plates used.

Slowly but surely the days are losing the rawness of the chilly spring, and resemble more and more the heated period that visits us with annual regularity. Now that a prolonged trip to a southern clime is in store for our soldier boys, it would be a good plan to provide each regiment with a quantity of Lundell fans, says the advertising man of the Central Electric Company.

The New Transformer recently placed on the market by the Moloney Electric Company, St. Louis, is fast verifying the prediction made by the makers a year ago, that it would become a formidable rival to older makes, as soon as its good qualities became known. In addition to high efficiency and close regulation, the makers say that exceptional care is exercised in submitting each converter to a high-pressure insulation test before shipment.

The Central Electric Company are carrying in Chicago stock Edison fuse plugs of all sizes, standard fuse wire put up in neat and attractive packages convenient for use, fuse links with copper terminals of all lengths and capacities, as well as a full assortment of fuse strips. The composition entering into their various fuse material is the result of numerous experiments, and practical tests have determined it to be a most accurate fuse material.

One hundred and fifty thousand telegraph poles in one pile would make quite a respectable pyramid, yet this is the quantity Naugle, Holcomb & Company, Chicago, carry in stock to meet the demands of telegraph, telephone and railway concerns throughout the country, who often depend upon quick shipments of poles for the completion of a line. Using 32 poles to the mile, the above-named quantity would build a line nearly 4,700 miles long; quite a respectable distance.

The Kerite Cables are to be extensively used by the government. A press dispatch from Connecticut, April 7, says: "The largest order that has yet been given by the government for submarine cables, to be used for torpedo purposes, has been received at the Kerite Cable Works, at Seymour, and it was conditional with early shipment. The order consists of 50 miles of single-conductor submarine cable and 15 miles of No. 7 conductor submarine cable. In order to fill the order at as early a date as possible the works will be required to run night and day for several weeks."

The Sprague Electric Company will exhibit at the Electrical Exposition, at Madison Square Garden. The exhibit will comprise a type of each Sprague electric elevator manufactured by that concern; a direct-connected lighting plant; Lundell power and fan motors; exhaust fan outfits; a printing machine in operation, together with blowing outfit; a cab of the London type with automobile motor and Sprague controller; screw pumps; armatures; conduit; switchboards and conduit racks. The Sprague company promises to make as complete an exhibit as has ever been made in their particular line.

The Lundell Motor seems to be gaining rapid recognition among large power users. It has given invariable satisfaction during all the years it has been upon the market. One of the latest contracts awarded the Sprague company is that awarded by the John Stephenson Car Company, of Elizabethport, N. J. Each of the Stephenson machines will have its independent Lundell motor, and the sizes used will be from three to 40 horse-power, mostly large size machines. Some of them will be direct connected, and some geared. In addition to the power motors, the Sprague company has secured a contract for exhaust fan outfits. The plant will be one of the largest of its kind in the country, and will employ only Lundell motors.

Northern Electrical Manufacturing Company—One of the most important agency contracts placed for several years past was consummated last week between the Northern Electrical Manufacturing Company, of Madison, Wis., and Kohler Brothers, of Chicago, whereby the latter firm becomes, for a number of years, the agent for the sale of apparatus made by the Northern Electrical Manufacturing Company, the territory embracing Illinois, Iowa, Missouri, Indiana, Nebraska, Kansas, Kentucky, Tennessee, Michigan, Ohio, Pennsylvania, New Jersey, Maryland, Delaware and the District of Columbia. Messrs. Kohler Brothers, having such excellent reports of the merits of the apparatus, and having, probably, sold more motors than any individual firm in the West, gaining thereby a most extensive knowledge of the business, took this step after the most thorough investigation of the Northern apparatus. They found it to cover a wider range of application and to meet more requirements than any other apparatus that had come to their knowledge. It can be but a matter of great congratulation to the Northern Electrical Manufacturing Company to have completed arrangements whereby it will have the benefit of the experience, ability and sound business policy of this well known Chicago firm.

WANTED.

Salesman to sell Lubricating Oils from samples on commission. Liberal terms.

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FOR SALE . . .

One 150-h.-p. Single-Cylinder Ball & Wood Engine, 16 x 16, 250 R. P. M. In first-class condition.

Two 60-k.-w. Edison Bi-polar Dynamos, in A No. 1 order.

One 60-inch 3-ply Leather Belt, 96 feet 0 inch long. Run but a short time.

For further particulars, address
J. F. OUTWATER,
360 Pearl Street,
Brooklyn, N. Y.

NAME THIS PAPER
Electrical Review
WHEN WRITING TO ADVERTISERS.

NOTICE TO CONTRACTORS—SEALED proposals for furnishing the materials and performing the labor required and necessary for installing the electric light wiring for the eastern approach, porticos and lobbies, and completing the electric wiring for the western staircase and fifth story of the state library; also for furnishing the electric light fixtures for the eastern approach, lobbies, porticos and western staircase, for the State Capitol at Albany, N. Y., may be sent by mail or delivered in person up to 12 o'clock noon on the 29th day of April, 1898, to the undersigned at his office in the Capitol, Albany, N. Y.

Only the bids of parties or firms actually engaged in electrical construction work and in the manufacture of electric light fixtures will be considered, and bidders must be able to refer to work similar in character, performed by them elsewhere.

Separate proposals must be made for the electric wiring and for the fixtures, and must be accompanied by a certified check or New York draft for a sum equal to ten per cent of the amount of such proposal to guarantee execution of contract, payable at sight to the order of the Superintendent of Public Works. Said deposit will be retained as a part of the security until the completion of the contract. The amount of bond for the faithful performance of contract, on execution of contract, will be forty per cent of the proposal or proposals, and the amount of labor bond required on execution of contract will be thirty per cent of the proposal or proposals.

The work is to be done with all the speed compatible with good workmanship, and the contractors are required to state the time within which they will bind themselves to complete the work, as the element of time will be considered by the Superintendent of Public Works in awarding the contract.

Drawings and specifications may be seen and blank forms of proposals obtained at the office of I. G. Perry, Capitol Commissioner, in the Capitol, at Albany, N. Y.

Original designs for electrical fixtures, together with plans and specifications, and proposals for furnishing same, as substitute for designs shown as above stated, will be received and given consideration.

The undersigned reserves the right to reject any or all bids as he may deem for the best interest of the state.

GEORGE W. ALDRIDGE,
Superintendent of Public Works.

IRON ROOF FOR SALE.

Width of building 155 ft., out to out, divided into a center span 66 ft., with a wing on each side 43 ft., 6 in.; total length of the building, 350 ft. This building is designed with brick sides and gable walls, with iron roof trusses and iron supporting columns; originally built for an iron foundry, but owing to the failure of the purchaser is now offered for sale at a bargain. Is admirably adapted for a foundry for light or heavy castings, machine shop, car barn, or for any other general manufacturing purposes. We guarantee the iron work as good as new, building never having been used.

Apply to
THE BERLIN IRON BRIDGE COMPANY,
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WANTED

Three Edison No. 20 (60 K.-W.) or three No. 32 (100 K.-W.) machine frames and armature cores only.

AKRON STREET RAILWAY AND ILLUMINATING COMPANY, AKRON, OHIO.

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to sell a patented device which should be applied to every street car in the country. For full particulars, apply to

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Bargains in Dynamos, Engines, Etc.

Direct-current dynamos of 350, 700, 725, 800, 810, 900, 1,075, 1,350, 1,610 and 2,500 light capacity.
Alternating-current dynamos of 750, 900, 1,300 and 2,000 light capacity.
Arc dynamos, 20, 24, 30, 40, 50 and 60 lights, both 1,200 and 2,000 candle-power.
Engines, 50, 75, 85, 100, 115, 125, 150, 175 and 200 horse-power.
Boilers, 100, 250, 375 and 500 horse-power.
Heaters, 150 and 2,000 horse-power.
Pumps, all sizes.

Write us for Price-list No. 21.

This apparatus has been removed from our own Central Stations to make room for larger units. We therefore know its history and can guarantee it to be in thoroughly good operative condition.

CHICAGO EDISON COMPANY, 139 Adams St., CHICAGO.

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED APRIL 5, 1898.

601,717 Solenoid blow-out for dispersing arcs formed in breaking electric circuits; S. S. Short, Cleveland, Ohio.—In a controller, a series of separable contacts, a conducting coil arranged adjacent to and having a central open space presented toward each pair of contacts, and means for cutting said coil into and out of circuit with said contacts.

601,730 Heat detector for electric fire-alarm systems; J. D. Gould, Brooklyn, N. Y.

601,758 Electric lantern; O. C. Prasse, West New Brighton, N. Y.—A battery, comprising a casing having a removable head thereon and a depending cylindrical carbon attached to said head, an enclosed porous cup and a removable zinc contained within said cup, the said cup and the said casing adapted for, respectively, containing chemical compounds, the said head having a diagonal vent containing mercury, leading therethrough for escape of gases.

601,768 Printing telegraph system; John Burry, Fort Lee, N. J.

601,871 Electro-magnetic circuit-breaker; G. S. Dunn, East Orange, N. J.—The combination of an electro-magnetic circuit-breaker, a latch thereon which permits it to move freely in one direction only, a resistance controlling switch, and a part on the resistance-controlling switch movable into the path of the latch.

601,979 Electric welding machine; C. Neilson, Brooklyn, N. Y.—In an electric welding machine, the combination with the vise, comprising a frame, a screw and a sliding block, provided with a circular recess in its center, set in the frame and connected with the screw of a clamping-jaw, having its top beveled from center to the sides, a dove-tailed groove in its apex, a pivoting device having a dove-tail-shaped base and a circular head, and of a screw passing through the head of the pivoting device and through the sliding block, and connecting the clamping-jaw to the sliding block of the device.

601,992 Electric brake mechanism; A. Vanderbeck, Scammon, Kas.—An electric brake operating device, having a magnet provided with contiguous spaced poles, and a polarized plunger terminally disposed between the poles of said magnet and adapted to be operatively connected with the moving parts of the brake mechanism.

INDUSTRIAL NOTES.

The Electrical Novelty Manufacturing and Construction Company, of 116-118 Green st., Brooklyn, N. Y., are issuing a very handsome illustrated catalogue embodying several new inventions, lately patented by the firm, and the means of using them. A general description on the uses of different electrical supplies handled by them will be dealt with, and also some practical advice on construction work. The catalogue will be sent free to any who may be interested.

The Long Island Railroad has greatly improved its service to provide for its rapidly increasing business. Mr. H. M. Smith, the traffic manager, realizes that the popularity of this beautiful and extensive sea coast island as a Summer home is growing every year, and the demand for railway accommodations during 1898 will probably be greater than ever before.

The Westinghouse Electric and Manufacturing Company has just opened a new branch office at Austin, Tex. Mr. J. E. Johnson will have charge of the office and of the further extension of Westinghouse business in the southwest. The large contracts which this company has been handling in Mexico and the Texas region have led to the establishment of this new center of electrical trade.

The New Perfection Dynamo Brush, manufactured by the Ohio Specialty Manufacturing Company, of Troy, Ohio, is attracting considerable attention among central stations. The brush is a combination of wire cloth, leaf copper and graphite, and needs no trimming or attention. It is also self-lubricating. The offer of the company to send sample brushes to any desiring a trial has gained a good market for it, and they report numerous stock orders from the different supply houses.

The Mica Insulator Company, having general offices at Chicago and New York, and also a branch office at London, England, have recently received an order for over 5,000 micanite segments of a large pattern from a large electrical machinery firm. Also an order calling for 2,000 segments from another firm and one of 2,600 segments from a motor company. The company report that the micanite segments are meeting with considerable favor among the machinery builders. The softness and evenness with which the segments wear away, they claim, cause great satisfaction to those using it. The firm offer to send free of expense a sample set of segments to any electrical manufacturers or repair concerns desirous of demonstrating the value of the same.

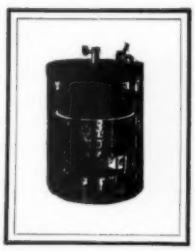
High-Potential Petticoat Insulators—The following statement has been issued: "My attention has been called to the fact that the R. Thomas & Sons Company, of East Liverpool, Ohio, are putting upon the market a high-potential petticoat insulator, which consists of two or more pieces fused together. Over a year ago I made an application for a patent for this same construction, and this application was allowed me in April. Instead, however, of paying the final government fee, and permitting issuance of the patent, I withdrew the claim for the purpose of inserting more specific claims than the generic ones which were allowed first to me. While my application was undergoing amendment, preparatory to making other claims, one of the persons connected with the R. Thomas & Sons Company filed an application, which was put into interference with my application. Preliminary statements as to the dates of invention were filed by each of us, and my preliminary statement shows that I made the invention more than a year prior to the invention made by the person connected with the R. Thomas & Sons Company. I desire to say that, in the end, priority of invention will be awarded to me, and the patent issued to me, and when it is so issued, I shall promptly bring suit against all users of these insulators of two or more parts. The patent issued the R. Thomas & Sons Company, March 8, 1898, is a limited patent covering only a method of making insulators, and can not be used after the issuance of my generic patent without infringement. I make this statement thus publicly, so that persons who purchase these insulators may be advised of my intentions. I claim to be the first to invent and produce a high-potential petticoat insulator, consisting of two or more parts fused or united together with glaze.

(Signed.) "FRED M. LOCKE.
"Victor, New York."

LYONS & BISSING.

MR. JOSEPH LYONS, Electrical Expert and Solicitor, and *MR. GUSTAV BISSING, late Principal Examiner of Electrical Division A, U. S. Patent Office,* announce the formation of a partnership for the general practice of PATENT LAW, with its offices at the McGill Building, WASHINGTON, D. C.

GORDON PRIMARY CELL



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REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

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Easter Greetings.

As usual, the American Electrical Works, of Providence, R. I., are out with appropriate Easter greetings. Being unable to send to each of their friends an Easter egg, they have sent a package of egg-plant seeds which they request their friends to plant and raise their own eggs from. This Easter souvenir is an unusually novel one and the neat idea has been acceptably carried out. The American Electrical Works are to be congratulated on their latest souvenir.

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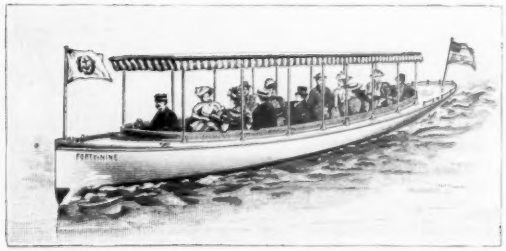

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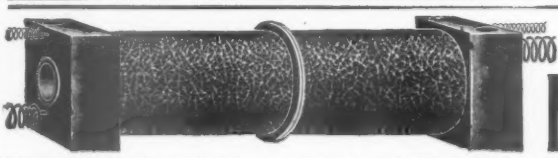

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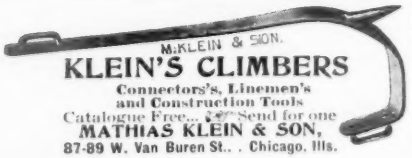

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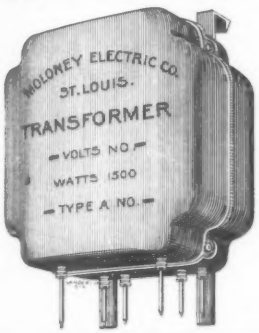

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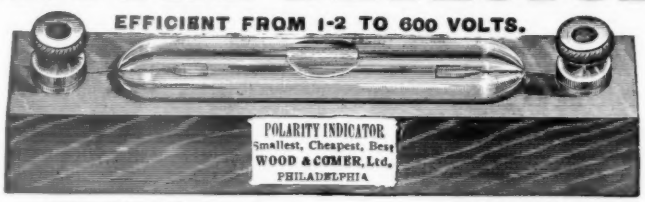

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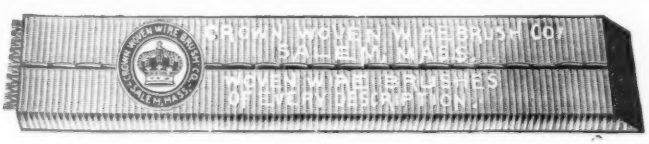

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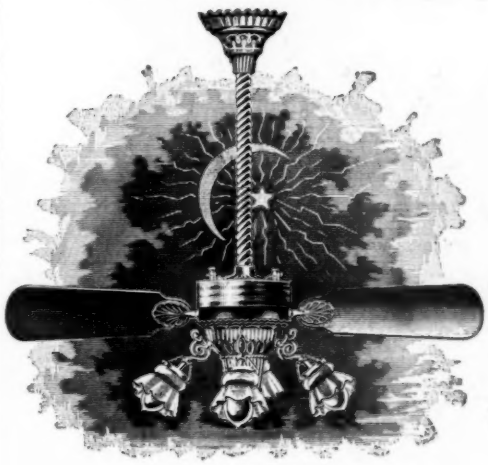

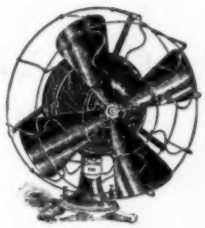

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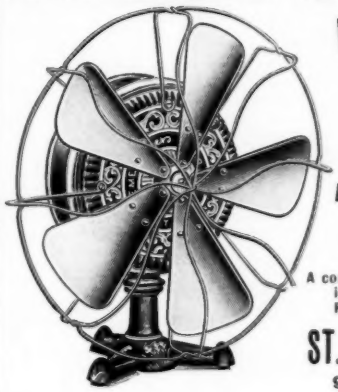

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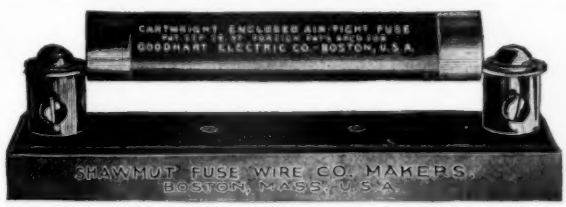

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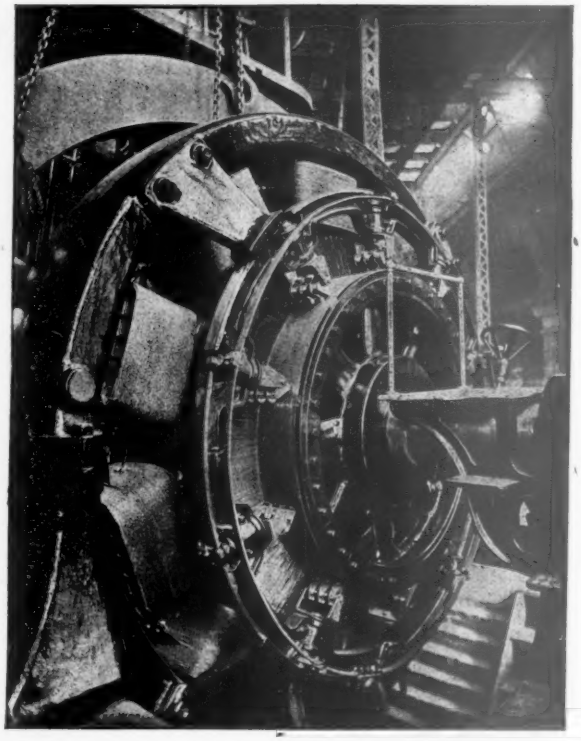

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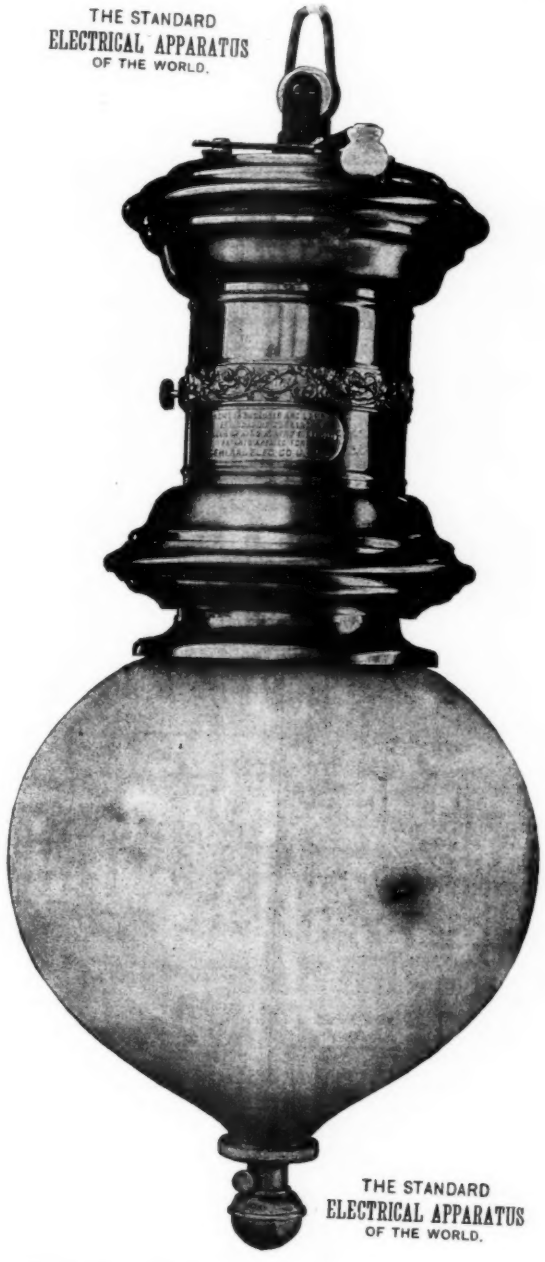

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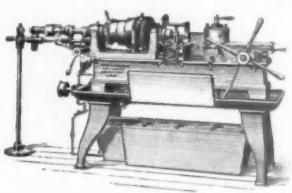

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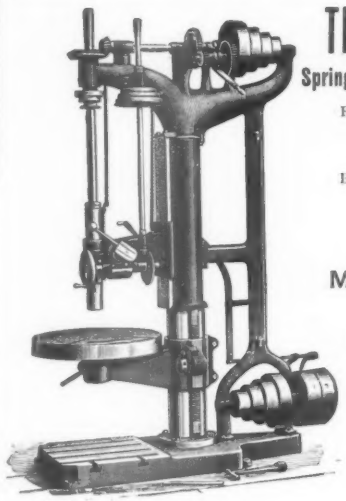

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General Electric Co.
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(See "Lamps.")

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Westinghouse Electric & Mfg. Co.

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Standard Underground Cable Co.
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General Electric Co.
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McLeod, Ward & Co.

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Edison Min. & Dec. Lamp Dept.
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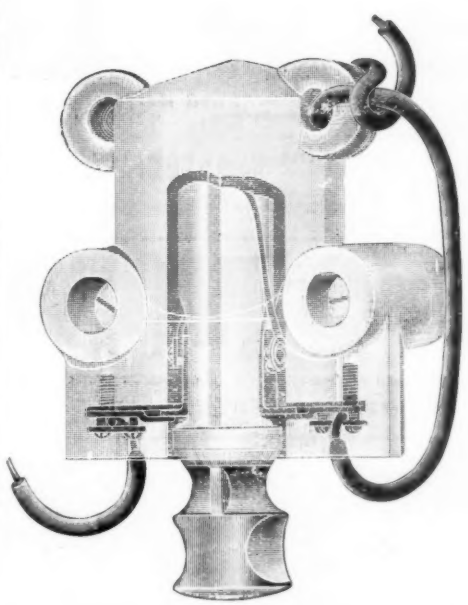

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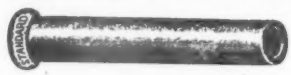

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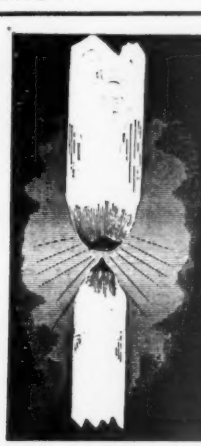

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